FEB 25 1927

THE ILLUMINATING ENGINEER

LIGHT
LAMPS
FITTINGS
AND
ILLUMINATION

THE JOURNAL OF
GOOD LIGHTING

Official Organ of the Illuminating Engineering Society

FOUNDED IN LONDON 1908

Edited by
LEON GASTER

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Floodlighting—The Brightness of Illuminating Glassware—The Work of the Illuminating Engineering Society (1908-1927)—The Lighting of Printing Works—Exhibits of Scientific Apparatus—The Use of Coloured Light in Kinema Displays—News from Abroad, etc.

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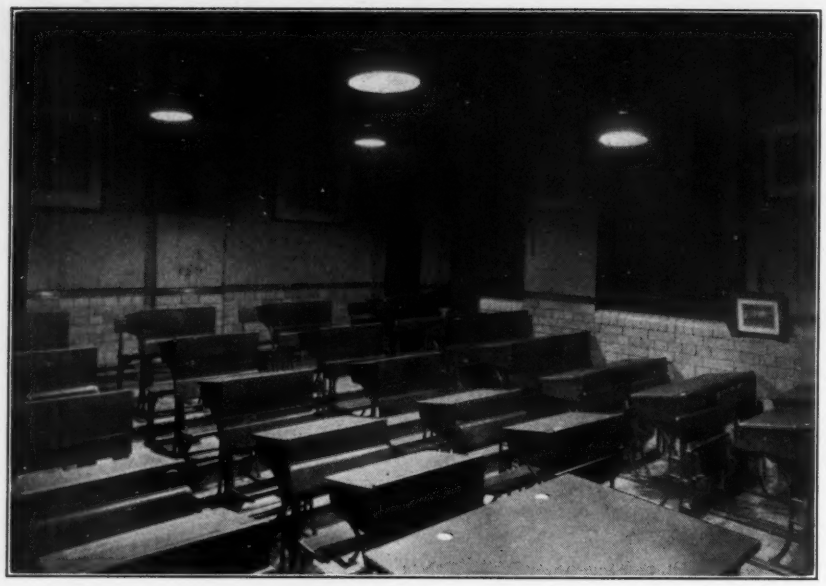

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The Work of the Illuminating Engineering Society (1908-1927)

IT is occasionally useful to review progress and take stock of one's position, and in this and our next issue we are accordingly giving a survey of the work of the Illuminating Engineering Society since its commencement. This is based mainly on the account presented in 1922, which has now been revised and brought up to date. The compilation has been undertaken in accordance with requests from several quarters. It should be useful in enabling members who have only joined the Society during recent years to form some conception of past work and the circumstances in which the Society came to be formed.

During the period under review the Society has done incontestably useful and original work. A glance over the list of papers during the past 17 years will show how many novel problems have been raised, and how the Society has approached in turn different sections of the community with the object of interesting them in the subject of illumination.

But the influence of the Society has extended far beyond its own gatherings. Its proceedings have been regularly reported in its official organ, *The Illuminating Engineer*, and thus (as we have good reason to know) brought to the notice of many who might otherwise have been unaware even of the existence of the Society. From the commencement a liberal policy has been followed in regard to other journals, advance proofs of papers being circulated simultaneously with the holding of meetings. As a result comments on the Society's work have appeared in over 100 different daily and technical papers, so that it is no exaggeration to say that the work has thus been brought before millions of people. This result is due in a large measure to the intimate personal relations of our Editor with the press in this country, whose services to illuminating engineering the future will decide.

Problems raised at meetings have been followed up in detail by joint committees by whom reports are issued. The Society is also linked up with numerous other important committees which have come into existence in order to deal with special fields of work, such as the Illumination Research Committee working under the Department for Scientific and Industrial Research; the Home Office (Departmental) Committee on Lighting in Factories and Workshops; and the various technical committees associated with the British Engineering Standards Association. All these researches and investigations should continue, for on this future progress largely depends. But the time has come when more attention should be devoted to propaganda and educational work—so that the benefits of good lighting may be brought before a much wider circle and the information acquired by the Society during 17 years of work broadcast in all directions.

Another point to which much attention has been given recently is the development of illuminating engineering abroad. There are now Illuminating Engineering Societies at work in the United States of America, Germany, Austria, Holland and Japan. This country should be kept fully informed of progress abroad, and should possess a powerful and well-supported Illuminating Engineering Society capable of voicing national views at international conferences. An important step in this direction, taken in 1925, was the issue of *The Illuminating Engineer* in a revised and extended form. In its new shape the journal has met with general approval. A special feature is being made of news from abroad, so that the journal should become a centre for information from all quarters.

But it is evident that if the Society and its journal are to fulfil completely the objects for which they were created considerably greater financial support must be obtained. Probably only a few of the members of the Society yet realize how great has been the burden shouldered by a few enthusiasts, and how much the Society owes to the fortunate arrangement by which *The Illuminating Engineer* acts as its official organ, so that the Society is relieved of the cost of publishing *Transactions*. Work done for the Society is entirely voluntary. It has no paid Secretary or Staff comparable with that available to other bodies of standing. The income it receives from all sources is only about one-twelfth of that received by the American Illuminating Engineering Society.

Considering the circumstances, it must be agreed that the Society has done remarkably well. So far as scientific repute and standing are concerned we all have every reason to be satisfied. But its usefulness might be far greater if operations could be conducted on a larger scale, and for this further assistance, both personal and financial, is necessary. Whence is this additional support to be obtained? The first and most obvious channel is by increasing the membership, and existing members are urged to do all in their power to induce others to join. But a further and more directly helpful step would be the creation of a number of "sustaining members"—bodies who directly benefit from the movement and pay a substantial contribution towards its expenses. More than one-third of the income of the American Society is derived from "sustaining members," and another third from the Associates, these two grades forming together the bulk of the membership. In this issue a form of application for membership is enclosed (p. 52), and it is proposed to reprint this section, with supplementary matter to appear in our next number.

Scientific Floodlighting

THE paper read before the Illuminating Engineering Society on the above subject by Messrs. W. J. Jones, H. Lingard and T. Catten was rightly regarded by those present as an excellent survey of the underlying principles of floodlighting. In our last issue we gave the paper *in extenso*. On this occasion we are dealing with the discussion (see pp. 37-42). The authors certainly realized one of the chief objects of a technical paper—to stimulate interest and comment by others. Numerous points offered opportunities for discussion, such as the "utilization factor" obtainable in practice, the relative advantages of mirrors of the parabolic and "sectional" type, the effects of covering glasses, etc.

Up till now few data on the principles of floodlighting have been available. It is possible that, as was suggested in the discussion, some installations have been carried out on rule-of-thumb methods. The paper should encourage the planning of schemes on more scientific lines. It also shows the variety of equipment now available. In the discussion the question was raised how far the beam candle-power depends upon the candle-power of the source and how far on its intrinsic brightness (as is broadly speaking the case in an optical lantern). A decision on this point seems to depend on the type of projector used, and the problem requires further elucidation. Closely linked with this question is the effect of using lamps with diffusing bulbs. The demonstrations showed very clearly the greater softness and uniformity of the light obtained when, for example, an internally frosted lamp is used with a sectional mirror projector. In cases where floodlighting is mainly used for "practical" objects (e.g., in enabling excavation or construction work to be carried out by night, or in illuminating dockyards, railway shunting yards, etc.), the diminution in glare occasioned by diffusing lamp bulbs, and the accompanying softer shadows should be advantageous. The same would doubtless apply to the floodlighting of buildings, where exception is sometimes taken both to the "hardness" of the shadows cast by pillars, cornices, etc., as well as distortion effects occasioned by the unusual direction from which the light comes.

The authors have given an excellent survey of the engineering side of the question. We should like very much to hear the views of architects, on whose goodwill the development of floodlighting as an art largely depends. There are great possibilities in floodlighting for decorative effect, and we should like to see it applied more frequently to buildings of distinction. The floodlighting of the Capitol at Washington is an installation that can scarcely be paralleled in this country, and furnishes a significant indication of the esteem in which the art is held in the United States. In this country we do, however, suffer under one very evident disadvantage, the soot-covered exteriors of buildings in most industrial cities. The useful table given by the authors showed how greatly the necessary illumination is affected by the surface; with very dirty stone or concrete, reflecting perhaps only 5 per cent. of the light, the conditions are almost prohibitive. Advocates of floodlighting have thus every reason to extend good wishes to the smoke-abatement movement, which, it is hoped, may eventually lead to a material improvement in the smoky atmospheres of our cities.

The Brightness of Diffusing Glassware

IN our last issue we referred to the very important report issued jointly by the Industrial Fatigue Research Board and the Illumination Research Committee, dealing with the Relation between Illumination and Efficiency of Fine Work. Some further comments on this report, pointing out its practical bearing, will be found on p. 53 in this number.

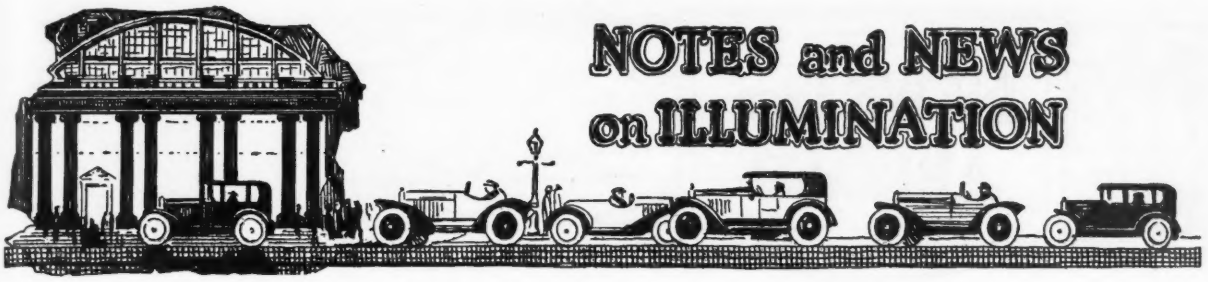
We have now to record the publication of another very useful Technical Report summarizing work undertaken by the Illumination Research Committee, No. 4, on the Brightness of Illuminating Glassware for Illumination. These results should be helpful, because very few data on the brightness of ordinary lighting glassware have hitherto been published. Eighteen different forms of glassware were examined, most of them being of the hemispherical pattern, the material being in general pot opal, cased opal or translucent glass. From the results assembled it appears that the brightness attained by such glassware, when used with the size of lamp for which it is intended, is very moderate. In one case only did the brightness of any portion of the glass exceed two candles per square inch, and, in general, the average brightness of the unit was very much less than this.

The maximum brightness attained by this glassware was therefore well within the limit of five candles per square inch prescribed by the Home Office Departmental Committee on Lighting in Factories and Workshops; it was also less than the average brightness of the white sky, which has sometimes been assumed as an indication of the brightness which the eye can comfortably tolerate at close quarters without discomfort. As such bowls are usually mounted relatively high up in the room, out of the ordinary range of vision, the consumer using them has little to fear in respect of glare. The introduction of varied designs of diffusing glassware of this kind, which provides an effective antidote to the brightness of the filament of the gasfilled lamps, has been one of the most satisfactory features of recent progress in the design of lighting fittings.

At the same time we think it would be injudicious at present to attempt to impose too rigid a limitation to the brightness of glassware for general use. In the case of lighting units placed very near the eye, complete screening of the source of light may be essential. But when units are mounted high up out of the direct range of view a greater degree of latitude may be desirable, and further search is necessary before we can assign definite limits. In many cases (for instance in restaurants, banqueting halls, etc.), a certain degree of "sparkle" may be permissible, provided one can keep below the point where sources become glaring. This point is largely determined by the nature of the background and surroundings.

Individual speciments of illuminating glassware not infrequently show appreciable variations. Judging from the uniformity of effect recorded it would appear that the glassware examined in these tests was of a superior type. Opal glass is usually effective in diminishing brightness, but marked differences in diffusing qualities exist. Such divergences were specially noteworthy during the war.

There seems to be room for greater precision in the terms applied to lighting glassware, and we hope that in the future it will be possible to frame a specification with which all approved illuminating glassware should comply.



The Use of Light as an Aid to Aerial Navigation

It is now just about five years since the most instructive paper on the above subject was read before the Illuminating Engineering Society by Lt.-Col. L. F. Blandy. Readers will be interested to note that another paper on this subject is to be read before the Society shortly by Mr. H. N. Green, who has been for some years carrying out researches in this field at Farnborough, the date provisionally selected being Tuesday, February 22nd. The problems involved are of great technical interest and have an important bearing on the future of aerial navigation. Much work has been done on the design of aerial beacons, etc. It has recently been stated that the record for brightness is held by the famous equipment on Mont Afrique, near Dijon, in France; this light is said to yield a beam of 1,000 million candle-power, and to be visible in clear weather at a distance of 400 miles.

Tramcar Lights and Safety

Reference is made in *Electricity* to a recent fatality at Manchester, where a man was knocked down by a motor-car on alighting from a Salford tramcar, which was in darkness. It is pointed out that on electric tramways this contingency is liable to happen scores of times nightly, as cars are left in darkness whenever the trolley is out of contact with the overhead line. Fortunately in most cases the places where contact has to be temporarily broken are usually situated in relatively well-lighted streets, so that the movements of persons getting on and off the car can be seen. Nevertheless, it would seem only prudent to install some form of emergency lighting, to be used when the trolley is being removed and swung round for the return journey. This is the more important because it is precisely at such points that people are liable to be leaving or entering the car. No doubt it would not be difficult to devise such an emergency system, which might consist of a couple of small lamps at each end of the car receiving current from an accumulator, these lights being automatically switched on whenever the contact with the main supply is broken. Such lamps would enable the car to be distinguished by other vehicles and give warning that people may be entering or leaving it.

The Use of Coloured Filters to Correct Colour-Blindness

In *The British Journal of Ophthalmology* reference is made to a curious case reported from France by M. Dufour, namely, that of a laboratory assistant who was colour-blind, but by much perseverance was able, with the help of coloured filters, to reproduce a coloured drawing with paint, almost exactly. Apparently such practice was needful, as early attempts showed confusion of reds and greens. The exact condition of colour-blindness is not indicated, but it would seem that the method used depended on applying the filters in turn to the observation of the picture and the paints used. It is evident that even to a colour-blind person the red would appear darker than green when viewed through a green filter, and vice versa. The ultimate distinction of colours was therefore effected largely by examination of differences of shade rather than hue. We believe that even without the aid of colour-filters persons who are relatively slightly colour-blind can often learn by observation of shade to discriminate colours surprisingly well —a point that needs to be kept in mind by the ophthalmologist in making examinations.

Better Lighting for Plant Construction

On the principle that the cobbler's children are always the worst shod, remarks *The Electrical World*, many light and power companies neglect proper lighting during the building and equipment of generating stations and substations. Whilst work is under way many temporary obstructions impair the utility of the permanent lighting. In the boiler house the great height of modern furnaces and the large capacity of tube sections demand the use of a great deal of staging during construction. In the turbine rooms units arrive in sections with parts packed in cases of large size, and it is necessary to pick one's steps carefully. The tendency is for 100-watt or 200-watt bare lamps to be used. Too little attention to avoidance of glare is paid, and the illumination is often inadequate. Fortunately the remedy is easy. Illumination can be increased by the multiplication of overhead units in proper reflectors, supplemented by a liberal use of well-designed industrial portables. Assuming that one hundred 500-watt lamps were thus required in a new station with an initial equipment rated at, say, 100,000 kilowatts, the cost of supplying this load would be only about 50 cents (approximately 2s.) per hour, and what does this amount to in comparison with the cost of labour on a modern construction job, and the value of each day saved in getting a unit of a high-powered station into operation?

The Lighting of Battleships

At a recent meeting of the New York Section of the American Illuminating Engineering Society members were afforded an opportunity of visiting the battleship *Cincinatti*, and a paper on the lighting arrangements was read by Lieut. W. M. Thompson, the Senior Engineering Officer. This illustrated the important part played by artificial light on a modern battleship. On the vessel described, three main circuits carry all the general lighting and the handles of switches are painted black. In "darkening ship" for action all these switches are pulled, and the blue lights—"battle lanterns" operated by red-painted switches—are substituted. Such places (chart rooms, etc.) as require white lights have snap switches on the doors, so that lights are automatically extinguished when the doors are opened. Other interesting and ingenious expedients were described; but one problem, the screening of furnace glow from aircraft, does not seem to have yet been completely solved.

The Relation Between Illumination and Efficiency of Work

With reference to the important research on the above subject carried out by the Illumination Research Committee (Department of Scientific and Industrial Research), which was dealt with in our last number, attention may be drawn to a very informative contribution by H. F. Stroer, which has been commenced in *Licht und Lampe*. We propose to give a summary of this article in due course. The first portion contains a useful summary of past work by Cohn, Korff-Petersen, Kimura, Kobis, and other physiologists, whose methods are compared with those adopted by investigators who have sought to relate illumination to output and accuracy of work. It is interesting to note that the latter problem involves factors quite distinct from those associated with tests of visual acuity; for example, speed of discrimination becomes important, and likewise the effect of fatigue experienced in long-continued industrial effort. The problem of estimating the degree of fatigue under different conditions of illumination is particularly difficult. Measurement of acuteness of vision, before and after work, affords some indication. Feree, in the United States, has sought to base conclusions on the period of time during which an object fixed by the eye appears respectively clear and blurred. Other investigators have used the frequency with which the eyelids blink as an indication of fatigue. One of the latest methods is based on an examination of the colour sense, which seems to be appreciably affected by fatigue. We hope to return to this subject shortly.

New Forms of Portable Lamps

Contrary to the expectations of some, the general rise in the standard of overhead general lighting in offices, etc., has not led to the disappearance of the portable lamp. In managers' rooms one often finds a local lamp installed, notwithstanding the relatively high general illumination, and for domestic use local well-shaded units would seem to be more popular than ever. In the latter case the object is doubtless partly æsthetic, but there seems reason to think that whatever the general illumination may be many people will continue to appreciate a still higher illumination on their desk or at the actual point of work. Experience abroad seems to confirm this view. Quite a variety of specially designed local units for industrial and office use have been put upon the market, some of them highly flexible in design. We notice in *L'Electricien* illustrations of two new types of portables. The first of these utilizes the familiar trough reflector, embodied in various desk-lamps in this country, the other type a bell-shaped reflector mounted on a base somewhat resembling that used for the telephone and pillar. A feature in both cases is the complete degree of adjustment, the lamp and reflector being capable of up-and-down movement, and also swivelling in any desired direction.

Illumination in Relation to Bakeries

It is announced that an important exhibition in connection with the bakery trade is to take place in Essen in July this year. Whilst the exhibition will deal primarily with materials and processes of the trade, special attention is to be devoted to illumination, not only for the processes in bakeries, but in connection with show-windows, cafés, etc. It is expected that leading firms in the lighting industry will be strongly represented.

Street Lighting in Amsterdam

A correspondent sends us a photograph, reproduced above, showing the lighting of the imposing Leidsche Plein in Amsterdam. This is a good example of the Continental tendency, on which we have several times remarked, to utilize relatively deep metal reflectors for public lighting—the idea being that the complete screening of the filament and the elimination of glare more than compensates for any drawbacks as regards uniformity of illumination. The nature of the reflector is here clearly shown on the lamp-post in the foreground. With such a reflector the filament is quite hidden from view, and persons in the street can only see a small portion of the illuminated surface. We understand that this particular reflector is of the all-metal type; more recently reflectors with a prismatic glass lining have been introduced, and this is favourable to more efficient and extensive distribution.

Incidentally the picture shows another Continental practice, namely, the attachment of luminous advertisements to lamp-posts. One of these is seen in the foreground. Such advertisement signs are usually mounted at a fair height, the eye-level being kept free for the usual illuminated notices of destinations of tramcars, etc.

A New Form of Electric Incandescent Lamp for Kinema Use

As is well known, the performance of electric incandescent lamps for kinema projectors has been materially improved by the use of a spherical mirror behind the filament. This has two advantages. It increases the proportion of the flux light usefully applied on the screen; it also gives a more continuous source, as the image of the filament can be made to coincide with the filament itself and to fill up the interstices in the spiral. The nearer the mirror can be brought to the filament the greater the percentage of flux intercepted and reflected. The idea of mounting the mirror *inside* the lamp bulb, as a permanent feature, therefore suggested itself. This has been done in a new form of projection lamp developed by the Osramgesellschaft, which is described in *Licht und Lampe*. A small mirror is attached to the main lamp supports within the bulb, and can be easily mounted in the standard 600-watt 15-volt lamp. This arrangement has also the advantage that the relative position of filament and mirror is determined once and for all, and fixed.

TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

Floodlighting

(Proceedings at the Meeting of the Illuminating Engineering Society held at the E.L.M.A. Lighting Service Bureau, 15, Savoy Street, Strand, London, W.C., at 6-30 p.m., on Tuesday, January 11th, 1927.)

AT the meeting of the Illuminating Engineering Society, held at the E.L.M.A. Lighting Service Bureau (15, Savoy Street, Strand, London, W.C.), at 6-30 p.m. on Tuesday, January 11th, the paper on the above subject by Messrs. W. J. JONES, H. LINGARD and T. CATTEN was read, and an interesting discussion took place. Mr. C. W. Sully (Director of the E.L.M.A.) presided.

After the minutes of the last meeting had been taken as read, the HON. SECRETARY read out the names of the following applicants for membership:—

Members:—

Dickinson, D. F. .....Electrical Engineer, 134, Whittington Road, Bowes Park, London.

Dunkley, S. F. .....Gas Sales Department, Gas Light and Coke Co.; 35, Park Drive, East Sheen, London, S.W.14.

Husband, F. .....Electrical Engineer, Messrs. Siemens Schückert, 109, Kingsway, London, W.C.

Smith, F. S. .....Chemist, Gas Light and Coke Co.; 28, Ellerby Street, Fulham, London, S.W.

Weald, W. .....Elm Works Ltd., Summerstown, Tooting, London, S.W.17.

Winterborn, E. .....Electrical Engineer, 73, Bolton Road, Harrow.

Associates:—

Subro, P. B. .....Engineer, Messrs. Andhra Engineering Co., Bezwada, India.

The names of applicants presented at the last meeting of the Society were read out again, and these gentlemen were formally declared members of the Society.*

The CHAIRMAN then called upon Mr. W. J. JONES to read the paper on "Floodlighting."†

Discussion

LT.-COMMANDER HAYDN T. HARRISON wished to congratulate the authors on a paper which was very interesting and would have much value for reference purposes on account of the useful data it contained.

He noted that they had confined most of their work to reflectors having a comparatively wide angle of distribution, but at the same time they had mentioned that a rectangular area, such as is generally presented by buildings, could be more efficiently floodlighted by covering it with numerous circular areas derived from more concentrated sources. He would point out that the greater concentration required could not be obtained with light sources of relatively large area, or silvered moulded glass reflectors which had not been accurately ground on the silvered surface, unless such reflectors were of considerable size. This fact had also been appreciated by the manufacturers, judging by the number of floodlights exhibited constructed of numerous plane surfaces of silvered glass.

This latter type of concentrating reflector was one which he had found to embody many advantages when using a light source of relatively large area, such as high-voltage gasfilled lamps, but as regards efficiency for concentrating purposes could not compare with a silvered metal reflector with a light source of small area such as that obtained by using a low voltage.

The reason of this was obvious when you considered the relative solid angle over which they operated. With the glass silvered on the back only the rays passing through the glass at angles approximating the normal could be utilized owing to the refractory value of the glass, whereas with silvered metal surface accurate reflection could be obtained at acute angles. When this accurate reflection could be relied upon at acute angles it was possible to utilize 75 to 80 per cent. of the luminous energy, whereas with pressed glass reflectors only about 20 to 30 per cent. was concentrated.

The figures relating to the reflecting value of various materials used for building purposes (Table I) were particularly interesting; for example, in the case of the British Empire Exhibition in which the buildings were of concrete (with the exception of certain of the Colonies such as the India Building) the reflecting value when first tested aproached 40 per cent., and the floodlighting installation was based on 25 per cent. After the Exhibition had been opened for a short time it fell to between 5 and 10 per cent. thus rendering the colour scheme useless unless the general illumination was reduced to the same extent.

As the success of Floodlighting so much depended on the reflecting value of the surface of the buildings or monuments to be illuminated, he would suggest that architects should bear this in mind and, when designing a building which, for advertising or other purposes, was likely to be floodlighted, provide a surface suitable for the purpose, but he did not think that this particular form of advertisement was likely to be generally adopted in this country.

MR. J. W. T. WALSH said that he would like to congratulate the authors of the paper on the production of a very useful contribution to the subject of floodlighting. He felt that as time went on the use of floodlighting would increase enormously and the usefulness of the paper they had heard that evening would increase correspondingly.

There were just a few minor matters in the paper to which he would like to refer. In Table 3 it was stated that a poster having a glossy surface required 10 per cent. more light than one with a matt surface. This increase was presumably to allow for the light lost by specular reflection from the surface, but one would have

* See *The Illuminating Engineer*, November, 1926, p. 315.

† This paper was reproduced in our last issue (January, 1927), pp. 5-13.

thought from general principles that the increase necessary would have been very much greater, say at least 100 per cent. It certainly seemed that an increase of 10 per cent. would be quite inappreciable to the eye.

He would like to draw the authors' attention to a slight slip in the statement of the rule for the application of the inverse square law. As would be seen from the equation quoted, the larger the source of light compared with the diameter of the mirror, the shorter was the distance at which the inverse square law could be applied. He would also like to disagree with the authors when they stated that for a multi-plane mirror the beam intensity was independent of the brilliancy of the source. Surely if the geometrical form of the source was unaltered the beam intensity was strictly proportional to the brightness.

The authors' definition of beam spread seemed a very suitable one. The definition of the edge of a beam as occurring at the angle at which the candle-power was one-tenth of the maximum was quite suitable for beams of narrow divergence, such as searchlights, and the authors' definition coincided with this in such cases.

Mr. Walsh wished to ask the authors if they had had any experience of a very lightly diffusing glass which had been used for various purposes at the National Physical Laboratory. The diffusion was quite sufficient to eliminate streaks, but at the same time it did not cause the rather serious loss of light indicated in figure 11 of the paper. The authors' method of making the measurements for figure 12 did not seem entirely satisfactory. It appeared that rotating ribbed glass alone was not strictly equivalent to rotating the whole fitting, unless one could be quite sure that the light distribution from the projector without this glass was strictly symmetrical.

With regard to glare shields, Mr. Walsh wished to ask the authors if they know whether any experiments had been made on the lines of using small concave spherical mirrors on the side of the lamp facing the surface to be floodlighted. It would appear from first principles that a more perfect screening of the source would be effected in this way without any undue loss of light. He would also like to ask whether any experiments had been made with a lamp of the stereopticon type instead of the usual projector type. This lamp when used with a backing mirror gave a source of considerable area having approximately uniform brightness, and it might be that such a source would prove very suitable for floodlighting purposes.

MR. W. MILNER also congratulated the authors. He believed that the paper was the first serious attempt made in this country to deal with the floodlighting problem on scientific lines.

There were, however, a few points on which he differed from the authors. Mr. Walsh had referred to the statement in regard to the intrinsic brilliancy of the light source. He himself had found that the size of the lamp materially affected the candlepower of the beam. The maximum beam candlepower shown that evening was almost proportional to the wattage of the lamp employed. He would like to know whether the authors had any data determining whether or no the beam candle-power was proportional to the number of sections of glass which formed the mirror? It would seem that by increasing the number of sections the maximum candlepower of the beam would be increased.

Spherical mirrors in front of the lamps had been tried but the results had not been altogether satisfactory—partly because of the difficulty in getting an accurate focus in the case of commercial apparatus.

With regard to the Isolux diagram, if he understood rightly, the testing surface was kept fixed and the projector was rotated; in other words the diagram was a record of illumination on a spherical surface of which the source was the centre. If they took a plane at right angles to the beam they would get more exaggeration of form than the authors had shown.

Table VI gave the characteristics of various commercial forms of floodlights. He thought that the authors were unduly optimistic, especially with regard to the coefficient of utilization. Floodlight projectors, particularly those of the shallow parabolic type, gave a comparatively narrow beam, and the only useful light was that reflected from the mirror. He thought that in these circumstances a higher coefficient of utilization than 35 per cent. could hardly be obtained. 10 or 15 per cent., and perhaps more, had to be deducted for absorption, and a further deduction had to be made for the light absorbed by the cover glass. He therefore thought that the actual figure was more likely to be about 28 per cent.

In this connection he would like to give a little hint that he had found useful. A simple method of determining areas was to take a piece of celluloid and mark on it the outlines of beams of varied divergences. The celulloid could then be placed on drawings and the area covered by projectors at various distances readily ascertained. This method was very convenient as a rough survey.

With regard to the shallow parabolic mirror, although it embraced a smaller angle than the deeper type it usually enabled a higher beam candlepower to be obtained, because the focal length was longer and hence the beam was less divergent.

Mr. THOMAS E. RITCHIE stated that he desired to associate himself with the congratulations tendered to the joint authors by the previous speakers upon the excellence of their work. He considered the paper an exceedingly valuable addition to the very scanty literature on the subject, and as a correct appreciation of the technique of floodlighting was of very great importance, he felt that the members should take as a compliment the fact that their particular Society had been selected as the body through which the results obtained should be made public.

Although generally in agreement with the contents of the paper, there were quite a number of points upon which he was unable to see eye to eye with the authors, and others upon which he very definitely disagreed with their conclusions. The paper covered so wide a field, and afforded so much food for thought that almost any one of the various sections into which it was divided would provide material for a complete evening's discussion. As, however, he felt sure that many of those present would have observations to make he would confine himself to those points which he considered of special importance. He had had several interesting discussions with Mr. Jones during the preparation of the paper, and was glad to note the incorporation therein of certain suggestions which he had been able to make, such as, for instance, the definition of the angle of beam.

Mr. Walsh had referred to the additional intensity specified in Table III as necessary for the satisfactory illumination of posters having a glazed surface. He (the speaker) was not at all clear from the paper whether, in the case of a poster having *both* a glossy surface and an intricate pattern, the intention of the authors was that the illumination should be increased by 10 per cent. only, or by 10 per cent. and 10 per cent., that is to say, by 21 per cent on the initial value. He presumed the latter, but thought the point might be made more clear. In any case, he considered the suggested values would prove hopelessly inadequate in many cases. Another point to which the authors had not made reference was the fact that many advertisers were now using very large painted signs with an extremely glossy surface. In other cases the signs were built up of enamelled-iron sheets, the surface of which had a high specular reflection. Both types had frequently to be floodlighted, and, from experience, he felt sure that the authors would find that, to give an appearance of equal brightness, such surfaces would require to be illuminated to an intensity very much greater than might be supposed by anyone who had not actually made the experiment. Another interesting point in connection with the floodlighting of posters, and one which was very frequently overlooked, was that, in the case of signs expressly designed for floodlighting, the effect by artificial light could be enhanced, without detriment to the effect by daylight, by so arranging the design, or scheme of colouring, that, in signs to be illuminated from below, the upper portions were lighter in character and colour than the lower portions, whilst in those to be illuminated from above

the opposite was the case. When so arranged the falling off in the intensity from the top to the bottom, or vice versa, which was usually very marked, was automatically balanced by the difference in colour, and the effect of the sign or poster as a whole rendered very much more pleasing.

Referring to the characteristics of commercial floodlights given in Table VI, Mr. Ritchie stated that he considered it most unwise to publish the coefficients of utilization given in the final column without very definitely linking them up with the particular make, type, wattage and voltage of the lamp used, and without, moreover, pointing out specifically that if other lamps were used markedly different results might, and in all probability would, be obtained. In support of his contention Mr. Ritchie had thrown upon the screen a slide (reproduced in Fig. 1) showing three illumination curves lettered A, B and C. He pointed out that the curves in question showed the illumination on a plane normal to the axis of the beam, and distant 25 feet from the light source, produced by one of the floodlights which had been demonstrated to the meeting, when equipped with three different lamps. The lamps were in each case standard E.L.M.A. lamps (by which he meant that in no case were they special floodlighting or projection lamps with concentrated or bunched filaments, or automobile lamps, but ordinary standard lamps as normally used for ordinary lighting purposes) of the same wattage, but of different filament construction and voltage. The use of these lamps, any one of which might be employed by any ordinary user, altered completely the beam angle of the projector, the maximum intensity in the beam, and, of course, the area covered by the beam under any given conditions of usage. Using the lamp which produced the illumination shown in Curve A_1 the beam angle of the projector was approximately 16°. Using the lamp producing the illumination shown in curve B, the beam angle of the same projector became approximately 36°, whilst when using the lamp producing the illumination shown in curve C, the beam angle was increased to something over 60°.

The maximum intensity in foot-candles was, for curve A, 142; for curve B, 47; and for curve C, 42. It would therefore be apparent that the maximum intensity shown by curve A was no less than approximately 202 per cent. greater than that shown by curve B, and approximately 238 per cent. greater than that shown by curve C. How was it possible, in such circumstances, to assign to the particular floodlight in question, which by the way was a perfectly standard article, a single coefficient of utilization which would be of any practical value to, for instance, the average electrical contractor requiring to use such an article?

Another very important matter arising out of such variations as he had referred to was the fact that *users* of floodlights should be careful to see that when new lamps were required they should either be of precisely the same make, type, wattage and voltage as those recommended, and installed by the illuminating engineer responsible for the designing of the installation, or it should be ascertained beyond question that any contemplated change in the lamps used could be made without prejudice to the results obtained. Unless this point was very carefully watched, lamps giving the illumination shown by curve A might, quite unwittingly, be replaced by lamps giving the illumination shown in curve D, or vice versa, with results which would probably come as a very great surprise to those concerned.

Mr. Ritchie also stated that he would like to point out that the formulæ given by the authors for the determination of the dimensions and area of the illuminated field given by an inclined beam were incorrect. He had telephoned Mr. Jones immediately he received the proof of the paper, and had pointed out to him the inaccuracies in question. The revised formulæ shown on the blackboard before them were more satisfactory than those given in the paper, but even this failed either to give the true minor axis or the correct area of the ellipse. He disagreed with the remark made by Mr. Jones during his reading of the paper as to the magnitude of any error which might be introduced in this way; and, as in any case if a formula must be given it was surely just as easy to give one which was correct as one which was incorrect, he hoped that the authors would look further into the matter.

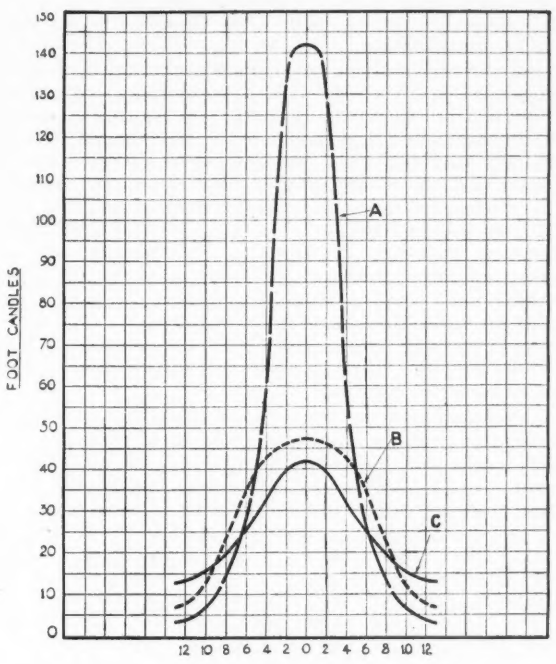


FIG. 1.—Angle to Axis of Beam in Degrees.

Finally, he would like to add a word or two to the authors' remarks on the use of colour. It was not, in his opinion, sufficient merely to allow for the absorption of the colour screens used, as was suggested in the paper. The effect upon the eye of light of different colours required careful consideration if perfect results were to be obtained. The subject was a complex one, and it might be necessary to provide either a very much higher intensity or a very much lower intensity, as compared with white light, according to the particular method of treatment adopted, or the particular effect desired. The beautifully tinted slide shown by Mr. Jones of the floodlighting in colour of the Royal Pavilion at Brighton, which had aroused so much interest in electrical and artistic circles, was an example of the type of result obtainable when all the factors he had mentioned had received due attention.

MR. C. A. MORTON said that the authors were to be congratulated upon the collection of a large amount of useful data on floodlights in general. There were, however, one or two points that he should like to mention. He did not like the word "reflectivity." There did not seem to be any need to bring into use yet another expression with a definition identical with that of the standard term.

It was rather a pity that the authors had not considered the point of filament design. Lamps made under B.E.S.A. Specification 161/1924, particularly the larger sizes, were obtainable with two types of filament construction. The filament might be either of the ring pattern or the festoon pattern. Each pattern would function differently in a given floodlight, and the differences in maximum beam intensity, beam angle and general character of the distribution were very marked.

The next point concerned the area of a wall illuminated by a conical beam, the axis of which is not normal to the wall. This was shown in figure 17. Mr. Jones mentioned that the construction for the minor axis was not quite correct, but that the error introduced is not serious. He (Mr. Morton) certainly agreed with this when the beam was of the concentrating pattern, but he would point out that when a dispersive beam was considered the error produced in the calculation of the elliptical area was serious.

Mr. L. G. APPLEBEE (Strand Electric and Engineering Co. Ltd.) expressed his appreciation of the excellent paper

which the authors had put before the meeting. Mr. Jones had referred to the question of the date of the introduction of floodlighting. He (Mr. Applebee) believed that one of the very earliest examples was the old open limelight used in theatres to flood cyclorama backcloths. This open limelight was probably the forerunner of the 180° horizon floodlights which Mr. Groom had demonstrated, and the 180° panorama lanterns which he himself had shown at previous meetings of the Society. The illuminant consisted of a cylindrical piece of lime fed from rubber bags on which the operator exerted the necessary pressure. In front of the cylinder of lime curved coloured glasses or gelatines were placed to get the necessary colour-effects. Cyclorama cloths of about 120 ft. in width and 30-50 ft. in height were illuminated in this way. This was done at Drury Lane in the time of Sir Augustus Harris, before the introduction of electricity into the building.

Mr. Applebee then proceeded to discuss some special applications of floodlighting, to which reference had been made in the early part of the paper. He subsequently described the use of modern floodlights for a variety of spectacular effects, illustrating his remarks by lantern slides showing, amongst other installations, the 1924 Tattoo, the Burma Pavilion, the First Finale of the 1926 Tattoo, and the Finale as eventually shown at the British Empire Exhibition. Attention was drawn to the special advantages of various types of floodlights for such work, and, in conclusion, Mr. Applebee exhibited a series of typical modern floodlights of the "Sunray" type.*

CAPTAIN W. J. LIBERTY remarked that floodlighting had found many useful applications in practice, as well as for decorative purposes. It had been used, for example, in assisting excavations and construction work to proceed at night. The chief difficulty in such cases was to arrange the lights so that there was no glare in the eyes of the workers. The sources should be mounted well out of the range of vision. Any system that was liable to throw direct light into the worker's eyes could not be considered satisfactory.

MR. A. CUNNINGTON asked one or two questions respecting applications of floodlighting. He said that the Southern Railway were commencing some experiments on floodlights as applied to railway yards and asked the authors if there were any alternative methods of overcoming the glare experienced when close to projectors.

The screen method mentioned in the paper had obvious objections when you wanted to make full use of all the light for covering the working area, and very high towers, as suggested by a perusal of practice in the U.S.A., might often be difficult to erect in existing premises.

Mr. Cunnington also asked whether it was considered probable that the reflection from the sides of brightly illuminated coaches or trucks would compensate for the fact that under floodlighting there was a grave tendency to cast deep shadows, and that such shadows between adjacent rows of vehicles in a shunting yard might be very harmful.

MR. J. S. DOW complimented the authors on their paper. He had had occasion to examine most of the papers on illumination read during recent years, both in this country and abroad, and he doubted whether so good an exposition of the problems of floodlighting had been presented even in the United States, which was generally considered the home of floodlighting.

Undoubtedly one of the most important questions raised in the paper was that of the part played respectively by the intrinsic brilliancy and the candlepower of the source. The remark of the authors in regard to the beam candlepower of projectors of the sectional type being independent of the intrinsic brilliancy was no doubt meant to convey that this was the case *for a given total flux of light from the source.* The distinction drawn between parabolic and sectional projectors in this respect might be likened to the difference between an optical lantern and an epidiascope. In the former case brightness of the source was the main factor; in the latter they were concerned with candlepower, because the only material consideration was the illumination that it was possible to direct on the object projected. If it were true that the maximum beam candlepower of sectional mirror projectors depended only on candlepower, then this form seemed to present advantages for many purposes; it would, for example, not materially diminish the beam candlepower if the bulb was of the internally frosted type—a practice which, as Mr. Jones had shown, was very beneficial in smoothing out irregularities and giving more even distribution. From the decorative standpoint he also believed that using a frosted or opal lampbulb had merits owing to the softer shadows. For construction work at night the diminution of glare was also a material advantage.

It would also seem that the sectional mirror type had greater possibilities of development, because one could always increase the power of the beam by using lamps of higher candlepower and building larger projectors; whereas in the case of a type of projector dependent primarily on intrinsic brilliancy possibilities were restricted—seeing that at present there was a well defined limit to the intrinsic brilliancy attainable in lamp-filaments. No doubt the system would give rise to a wider angle of dispersion, and hence a lower utilization factor in the case of distant objects. But for comparatively near work this objection did not arise to the same extent; whilst even for long range projection there might be cases where maximum beam candlepower, rather than coefficient of utilization, was the most important factor.

Mr. Walsh had alluded to the possibility of using small spherical mirrors as a means of masking the glare from direct rays. It might be interesting to mention that this problem had recently been closely studied in Germany, in connection with kinema projectors. A note on this subject had recently been published in *The Illuminating Engineer.* The research led to the conclusion that the use of such supplementary mirrors led to a distinct increase in the efficiency of the kinema projectors; hence, in the case of floodlight projectors, they might also prove to be without detriment to the efficiency if scientifically applied.

MR. C. W. SULLY (Chairman) congratulated the authors on the paper, which contained a considerable amount of valuable information and embodied the results of much research.

MR. H. H. LONG (*communicated*): In the first place I would like to say how much I appreciate the enormous amount of research work which has been carried out by the authors in order to be able to present such a comprehensive paper on a subject with reference to which very little of a technical nature has been written in the past.

In their introductory remarks the authors refer to the objection that is sometimes raised that floodlighting from below produces unnatural shadows. In this connection I should like to point out that a person views a building at night from below and, therefore, the majority of the building face will appear to be illuminated, as such ledges, etc., as cause shadows to fall above them, will also obscure vision of the shadows; whereas if the floodlighting were from *above* these ledges would cast deep shadows below them, which would obviously be immediately seen by a person in the street. This, therefore, is a strong argument in favour of floodlighting from below.

With reference to the various comments passed in the discussion on the authors' use of the term "reflectivity;" I would like to point out that the symbol for the correct term "reflection factor" is ρ and not α as used in this paper. It would be in the interests of all concerned if the British standard terms and symbols were used in all papers printed in *The Illuminating Engineer.*

I am not clear on the authors' remarks under the heading "Brightness Factor" where, in paragraph 2, it is stated:

> "Where a floodlighted object subtends a large angle of view, in general, a lower brightness is requisite."

*An illustrated description of these exhibits appears on page

Further on the next paragraph appears:

"... there is little need to provide extra light due to the elevation of the object and the consequent small angle that it subtends to the eye."

These two statements appear to me to be conflicting.

Under the heading "Coefficient with Utilization" the bare lamp light which is not controlled is referred to as "waste light" and not considered in the overall efficiency of a floodlight unit. I was glad to note that Mr. Jones qualified this when actually reading the paper to the effect that this applied more specifically where the throw was a considerable distance; as where a unit is fairly close to the object to be floodlighted the bare lamp light is of considerable use.

Referring to Table 6, I suggest that the words "High Voltage" appearing at the head of column 3 should in effect be at the head of column 2, as they refer to the type of lamp.

Where dealing with spilt light and as illustrated by Fig. 22 it is contended in the paper that,

"... where, however, a large building is concerned involving a number of units, the loss will not be so great."

Although the actual loss will not be so great I contend that for practical purposes the illumination on the building will still be mainly of the same value with no over-lap, as the over-lap will only result in certain parts of the building being lighted to a higher value and the spaces between will not benefit.

In the "Notes on Installation—Example (c)," two alternatives are given, one being to floodlight from units fixed to the building face itself, the other to instal the units on neighbouring buildings across the road. In this connection I would like to point out that although theoretically the illumination resulting from an installation of the latter type should produce a higher illumination due to the beam falling practically perpendicularly on the surface, in actual fact there are several disadvantages attendant on this form of installation. These are:

(*a*) A large loss of overall efficiency due to a large percentage of the light passing through the windows.

(*b*) The inconvenience caused to traffic and pedestrians in the street due to reflections from the windows.

(*c*) The inconvenience caused to people inside the building due to the glare of the floodlights seen through the windows.

(*d*) The inconvenience of having one's property installed on another building.

Owing to these disadvantages a better result with higher overall efficiency is usually obtainable by the installation of the units either on the building itself, or in close proximity of the courtyard thereof.

Mr. Haydn Harrison remarked in the discussion that he has experienced considerable difficulty with glass mirrors. It is surprising that more work has not been done in the development of plated metal reflectors, and I might mention that a new process of chromium plating is now being employed which has several distinct advantages over the mirrored glass reflector. These are:

(*a*) No distortion of beam due to refraction in glass.

(*b*) A surface which will stand up to very high temperatures indefinitely without detrimental effect.

(*c*) A surface which is dead hard and cannot be scratched with ordinary cleaning.

(*d*) A much more simple unit which is unbreakable.

Mr. L. GASTER, after congratulating the authors on their paper, pointed out the very great importance of the nature of the surfaces of buildings illuminated and the drawbacks of a coating of soot, such as was usual in large cities. It was to be hoped that the smoke abatement movement would bring about an improvement in this respect, which would make a great difference to the possibilities of floodlighting. The same consideration applied in a lesser degree to illuminated posters, which soon became obscured by dirt, and therefore required to be changed or renovated at frequent intervals. Mr. Gaster also pointed out that the effectiveness of an illuminated poster depended not only on the contrast of its brightness with that of the surroundings, but also on the *site*. Positions at corners of streets were particularly effective, because they were much more likely to catch the eye. The habits of people in this country were somewhat different to those of the inhabitants of some Continental cities, who were more disposed to gaze about them.

Mr. W. J. JONES, in reply, wished to remind the meeting that without the very able and conscientious work of Mr. Lingard and Mr. Catten it would have been impossible to produce the paper.

Mr. Dow had considerably helped him in regard to answering the query raised by Mr. Walsh on the subject of beam candle-power of sectional mirrors. It was certainly the intention of the authors to convey that the beam candle-power of projectors of the sectional type was independent of the intrinsic brilliancy of the light source, providing lamps of equal light flux were considered. There was, however, a limitation to this, namely, that each section of the mirror should be of sufficient size to contain a complete image of the light source. This is generally true where filaments are concerned, but immediately an opal or white-sprayed lamp is used this condition does not hold.

Mr. Walsh and Mr. Ritchie referred to the problem of lighting glossy posters. The figures quoted in the table are given by C. A. Atherton in his paper on Electrical Advertising, and it is understood only relate to the slight gloss obtained on some posters. In my opinion the criticism of Messrs. Walsh and Ritchie on this point is justifiable, and certainly when the surface consists of enamelled iron sheets, which have a high value of specular reflection, at least double the total amount of the illumination would be required. The question of the methods of testing spreading glass units had been raised by several speakers. It had previously been found that the uniformity of the beam from the floodlight alone (i.e., without spreading glass) was remarkably good for practical purposes; variations in different planes should be ignored. The spreading glass was placed in position with the ribs vertical, and the whole unit rotated in a horizontal plane, and at every 2½-degree intervals readings of the illumination were taken at a distance of 100 feet.

The spreading glass was then rotated 2½ degrees, and the whole unit again rotated horizontally. By these means readings were obtained in a plain at 2½ degrees of the horizontal. Similar sets of readings were obtained for various angles of orientation of the glass. The whole of the readings were then plotted on polar curve paper, and in this case represented the illumination obtained at the surface of a sphere 100 feet radius. In calculating the lumen values it was necessary to make corrections to reduce the areas to spherical conditions.

With regard to the stereopticon lamp which had been mentioned, he was under the impression that it was only available for use with a low wattage, but perhaps further information might be obtained on the point. He also wished to thank Mr. Walsh for pointing out several typographical errors.

The author was in a great measure in agreement with the criticisms raised by Mr. Milner. In Table 8 it would be noted that the coefficient of utilization for the shallow mirrors is only given approximately, and in the tests which were made difficulties were encountered due to the fact that the beams obtained from shallow mirrors are invariably very uneven, and when a standard lamp is being used is not quite circular. Perhaps the only satisfactory way of getting an accurate coefficient of utilization of these units is by plotting isolux diagrams. He was certainly interested in the hint that Mr. Milner gave of determining areas covered by floodlight units.

Mr. Ritchie very kindly expressed his appreciation of the paper, and his observations on the various matters were greatly valued. The question of poster lighting had already been referred to, while the suggestion he gave as to gradation of colours on posters was exceedingly interesting and useful. Mr. Ritchie also raised the very important point of different makes of lamps and the

resultant illumination. This illustrated only too well the desirability of more complete standardization. Such variations as he had shown were more particularly applicable to the concentrated types than units giving a wider beam-spread.

In some tests made on the influence of beam-spread on coefficient of utilization, the authors were surprised to find that the coefficient of utilization did not vary very greatly with the beam-spread, and he would therefore expect that the three tests shown by Mr. Ritchie, while giving widely different beam-spreads, would, if the lamps were of equal lumen output, give approximately equal coefficient of utilization. He had tried to check this from the curves themselves, but the information thereon was incomplete for this purpose.

If this was the case—and it certainly required confirmation—it would appear that in an installation where multiple floodlights are used the variation in beam-spread and beam intensity became relatively unimportant compared with the coefficient of utilization, since there is so much overlapping of beams.

The author was indebted to Mr. Ritchie for his remarks on the formulæ for determining the dimensions and area of the illuminated field given by an inclined beam. The following gave, they believed, the more accurate representation:—

Reference should be made to Fig. 17 in the paper.

Let b = divergence of beam,

α = angle of inclination.

Length of illuminated field

$$= D_1\left[\tan\left(\alpha+\frac{b}{2}\right)-\tan\left(\alpha-\frac{b}{2}\right)\right]$$

$$\text{Ellipticity of lighted area} = e = \frac{\sin\alpha}{\cos\frac{b}{2}}$$

$$\text{Width of lighted area} = \text{length} \times \sqrt{1-e^2}.$$

It should, however, be borne in mind that when wide-angle floodlights are used any attempt to project them at angles of considerable obliquity is sure to bring about patchy and uneven results. Mr. Ritchie had also raised the very important question of colour. It was not intended that more than a casual remark should be given to this question; but the authors found themselves in substantial agreement with Mr. Ritchie's remarks on this subject.

Mr. Morton had mentioned the question of filament design. There was no wish to gloss over the matter, but it was too complex to be dealt with adequately in the time at disposal that evening.

The term "reflectivity" came from the late Dr. Thompson, and was thoroughly ingrained in his (the speaker's) mind. Mr. Walsh had whispered to him that the official term was "reflection factor," and this term should be adopted in writing further on the subject.

With reference to the remarks of Mr. Long, he had not had an opportunity of experimenting with the chromium-plated reflectors, but there was little doubt that if opportunity afforded some very interesting results would be brought out.

He was delighted to hear the remarks of Mr. Haydn Harrison, and regretted that he was unable to answer his questions in detail. The authors regretted that they had not an opportunity of examining reflection from other than glass surfaces.

A further typographical error was to be found on page 8, for the candle-power edge of beam to give uniformity on the surface of 10:1. It should read:—

$$\text{C.P. edge of beam} = \frac{\text{C.P. centre of beam}}{10 \times \cos^3\frac{\theta}{2}}$$

where θ is the beam-spread.

In conclusion, Mr. Jones expressed, on behalf of the authors, their thanks to the various speakers for their important contributions to the discussion, and also their appreciation of the facilities which had been placed at their disposal by the Electric Lamp Manufacturers' Association.

A cordial vote of thanks to the authors, to Mr. Sulley for presiding, and to the E.L.M.A. Lighting Service Bureau for their hospitality, terminated the proceedings.

Scientific Apparatus Exhibition

ARRANGED JOINTLY BY THE PHYSICAL AND OPTICAL SOCIETY.

The seventeenth annual exhibition of scientific apparatus, arranged by the Physical and Optical Societies at the Imperial College of Science and Technology (South Kensington), during January 4th-6th, contained many items of interest. In our next issue we propose to give a somewhat fuller account of the exhibits. Meantime attention may be drawn to a few of chief interest in relation to photometry and illumination. One of the most striking exhibits was that arranged by the British Research Association of the Woollen and Worsted Industries. Besides a display showing the effect of artificial light in causing fading, the use of a small cabinet filled with ultra-violet light, to reveal latent defects of fabrics, attracted much attention. The fluorescence excited by ultra-violet light seems likely to prove a useful method of test in many industries.

There was a considerable range of special photometric apparatus, including photometric cells, and the "Sector Polar Distribution Photometer" exhibited by the G.E.C. Research Laboratory. The National Physical Laboratory had on view a specimen of the small model room for determining access of daylight into interiors. The new "luxometer" was included in the display of Messrs. Everett, Edgcumbe & Co. Ltd., and much of interest in the way of spectro-photometric and colorimetric apparatus was shown by Messrs. Adam Hilger & Co.

An Exhibition of Lighting in Rotterdam

An exhibition devoted entirely to illumination is something usual, but we have received from Dr. N. A. Halbertsma an account of a very instructive display of this kind, which was recently organized at Rotterdam under his supervision, as Secretary of the Dutch Illuminating Engineering Society. We shall be giving an illustrated account of this exhibition shortly. The main feature was the ingenious assembly of booths to illustrate various lighting effects, good and bad methods, etc. The exhibition was staged by the Academy in Rotterdam, with the support of the newly formed Dutch Illuminating Engineering Society, the Museum of Labour, and the local municipal electric supply undertaking. This prompt initiation of propaganda in the interests of good lighting reflects great credit on the enterprise of the Dutch Society and its energetic Secretary.

Physiology as the Basis of Illuminating Engineering

We have been favoured with a copy of a recent contribution to the *Zeitschrift des Vereines deutscher Ingenieure*, by Prof. Dr. J. Teichmüller, who will be known to our readers as the Director of the *Lichttechnische Institut* at Karlsruhe and as the organizer of the special illumination exhibit at the "Gesolei" Exhibition in Düsseldorf. In this article Dr. Teichmüller emphasizes the fact that the physiology of the eye underlies all successful illuminating engineering. It is sometimes argued that the illuminating engineer has little to do with these considerations; provided he meets "practical requirements" all is well! But unless the comfort of the eye is studied lighting schemes will not fulfil practical requirements in the true sense of the word.

The article is illustrated by several photographs showing displays at the "Gesolei" Exhibition. In one room models showing the structure of the eye and diagrams illustrating its reactions to light are presented; in another room one notes a demonstration of its sensitiveness to brightness. Other illustrations show methods of desk lighting, luminous signals for the guidance of traffic, etc. All illustrate how specific lighting problems can only be completely solved by a knowledge of the behaviour of the human eye.

The Surface Brightness of Diffusing Glassware for Illumination*

IN the introduction to this report it is mentioned that the experiments were carried out at the National Physical Laboratory, in compliance with a request received from the British Engineering Standards Association. The investigation was conducted by Mr. C. J. W. Grievson, B.Sc., M.A., of the National Physical Laboratory.

Method of Measuring Brightness.—The report gives the result of measurements of the surface brightness of 18 diffusing bowls used for interior lighting. Each bowl was fitted with a gasfilled electric incandescent lamp of the size for which the makers stated it to be suitable. The brightness was measured by means of a portable illumination photometer having a detached test surface. The reflection factor, ρ, of this surface was determined by subsidiary experiment, so that the brightness of any region of a bowl could be determined directly by substituting it for the photometer test surface. The photometer was calibrated in foot-candles, hence its readings were multiplied by the factor $\frac{\rho}{144\,\pi}$ to obtain the brightness in candles per square inch.

Description of Bowls.—The diffusing bowls examined were representative of several different types. According to their shape and size they could be separated into three groups. The first group comprised five bowls (Nos. 1, 2, 15, 16, 17) which were hemispherical in form and about 16 inches in diameter at the rim. The second group included six hemispherical bowls (Nos. 3, 4, 10, 11, 12, 13) with a rim diameter of 12 inches. Two other bowls with the same diameter (Nos. 6, 7) were also included in this group, although they departed somewhat from the hemispherical shape. Finally, the third group included all those bowls (Nos. 5, 8, 9, 14, 18) varying in size and shape which enclosed the lamp more or less completely.

From the standpoint of the material of which the glassware was made, the bowls again fell into three groups. The types of glass were: (1) White or pot opal; (2) flashed or cased opal; (3) translucent alabaster. Five bowls were of pot opal glass, namely Nos. 1, 2, 9, 11, 18. Nine (Nos. 3, 5, 6, 7, 10, 12, 13, 14, 15) were of cased opal glass, and the remainder (Nos. 4, 8, 16, 17) were of translucent alabaster ware.

TABLE I

No.	Max. Diam. of Bowl	Other Dimensions	Type of Glass	Shape and other Characteristics	Lamp Size
	in.	in.			watts
1	16		Pot opal ..	Hemisphere	300
2	16		,, ,, ..	,, ...	300
3	12		Cased opal ..	,, pale green	200
4	12		Translucent	,, ribbed ..	200
5	12	Depth 6½ Rim 5½	Cased opal ..	Enclosing unit ..	100
6	12	Depth 5½ Rim 10	,, ,, ..	Flattened hemisphere; pale green	200
7	12	Depth 4½	Frosted opal	Flattened hemisphere	200
8	10		Translucent	Sphere; fluted ..	100
9	10	Depth 8½ Rim 6	Pot opal ..	Enclosing unit ..	100
10	12		Cased opal ..	Hemisphere	200
11	12		White opal	,, ...	200
12	12		Cased opal ..	,, ...	200
13	12		,, ,, ..	,, ...	200
14	14	Depth 8½ Rim 4½	,, ,, ..	Enclosing unit; semi-matt	100
15	16		,, ,, ..	Hemisphere	300
16	16		Translucent	,, fluted ..	300
17	16		,, ..	,, wide and narrow ribs	300
18	12	Depth 9 Rim 6	White opal	Enclosing unit ..	100

In the original report photographs are included showing the general appearance of the bowls. Their dimensions and the size of the gasfilled lamps used with them are given in Table I.

Description of Tests.—In carrying out the test each bowl was hung some distance below the ceiling and supplied with its appropriate gasfilled lamp. As will be seen from the tables, most of the bowls were hemispherical. Except in the completely enclosing units the filament of the lamp was arranged to be just below the level of the rim of the bowl. In those, like No. 5, with surfaces far from spherical, the filament was placed approximately level with the maximum diameter. Observations of the surface brightness of the various parts of the bowls were made, particular attention being paid to the brightest spots visible. Measurements of the change in brightness per unit distance on the glass surface were made where this change appeared to be larger than usual.

The areas within which readings were taken varied to some extent with the shape of the bowl, but in general they were the following three (see Fig. 1):—

(1) The zone (AB) comprised within the first two or three inches below the rim.

(2) The zone (BC) centred about 45° radii vectores from the centre.

(3) The central area (CD).

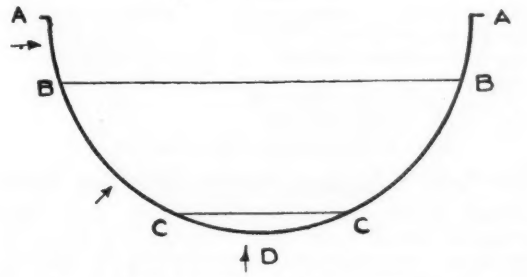


FIG. 1.—Zones in which observations were made.

TABLE II

Bowl No.	Bowl Size	Bowl Type	Lamp Size	Lamp Distance of Filament below Rim	Brightness of Surface In Zone AB	In Zone BC	In Zone CD
	in.		watts	in.	candles per sq. in.		
1	16	Pot opal	300	0	0·44	0·49	0·89
2	16	,, ...	300	0	0·23	0·54	0·81
3	12	Cased opal	200	0	1·16	1·37	1·80
4	12	Translucent ribbed ..	200	0			
		On ribs	—	—	1·29	1·39	2·13
		Between ribs	—	—	1·72	2·01	2·13
5	12	Enclosing cased opal ..	100	2	0·74	0·64	0·54
				2½	0·74	0·73	0·63
6	12	Cased opal	200	0	1·22	1·35	1·81
7	12	Frosted opal	200	0	0·74	0·68	1·34
8	10	Translucent sphere ..	100	5			
		Towards central bright spot :—					
		On ribs	—	—	2·08	2·37	0·57
		Between ribs	—	—	2·46	2·75	0·57
		Area surrounding central bright spot :—					
		On ribs	—	—	0·98	1·08	0·46
		Between ribs	—	—	1·27	1·23	0·46
9	10	Enclosing unit pot opal ..	100	3	0·79	0·50	0·70
				4	0·76	0·52	0·81
10	12	Cased opal	200	0	1·21	1·58	1·74
11	12	White opal	200	0	0·94	1·04	1·31
12	12	Cased opal	200	0	1·18	1·46	1·54
13	12	,, ,, ...	200	0	1·14	1·34	1·54
14	14	Enclosing unit cased opal	100	2½	0·89	0·70	0·53
15	16	Cased opal	300	0	0·72	1·27	1·57
16	16	Translucent fluted ..	300	0			
		On flutings	—	—	1·32	1·45	1·45
		Between flutings ..	—	—	1·89	1·53	1·45
17	16	Translucent ribbed ..	300	0			
		On narrow ribs	—	—	1·53	1·42	1·54
		On wide ribs	—	—	1·43	1·38	1·54
		Between ribs	—	—	1·94	1·46	1·54
18	12	Enclosing unit white opal	100	3	1·09	0·68	0·77

* Abstract of Technical Paper No. 4, issued by the Department of Scientific and Industrial Research, obtainable from His Majesty's Stationery Office (Kingsway, London); price 9d. net.

Results of Tests.—The results obtained from this test are given in Table II. The numerical values are given in candles per square inch.

Bowl No. 8 was the only one of the 18 in which the lamp filament was visible as a red thread. From whatever direction it was viewed there appeared, surrounding the filament, a central bright region covering about one-quarter or one-third of the apparent (projected) area of the bowl, the rest of which was comparatively dark. Two complete sets of readings were taken, one giving the brightness of the surface as viewed normally, looking towards the central bright patch, and the other the brightness as viewed obliquely, looking towards the area just at the left or right of the central patch. This is indicated in the diagram by the normal and oblique arrows at the glass surface. The oblique arrows are to be imagined directed through the plane of the paper, either inwards or outwards.

The tests for uniformity of diffusing properties showed that the bowls under test were very good specimens of diffusing ware.

In most of them the change of brightness in a distance of 1 inch along the line of a vertical section was very small. Only the four bowls mentioned in Table III showed changes of brightness per inch greater than 10 per cent. of the mean value in the neighbourhood.

TABLE III

No.	Bowl Size and Type	Maximum Brightness-change per inch
1	16-inch pot opal	23 per cent.
2	,, ,,	31 ,,
7	12-inch frosted opal	33 ,,
13	12-inch cased opal	17 ,,

The New Chicago Street-Lighting System

Some further particulars of the new street-lighting system in Chicago, to which reference was made in our last issue, are given in a contribution by Mr. S. W. Thompson to *The Electrical World*. This is considered to mark a great advance in the intensity of illumination provided, as is indicated by the accompanying table:

COMPARATIVE LIGHTING INTENSITIES OF SOME LARGE CITIES.

	Lumens per Linear Foot.
State Street, Chicago	2,000
Salt Lake City, business section	822
Niagara Falls, Falls Street	761
San Francisco, Market Street	750
Schenectady, Erie Boulevard	700
Portland, Ore., business section	600
Schenectady, State Street	585
Indianapolis, business section	520
Los Angeles, Broadway	510
San Francisco, Triangle district	500
El Paso, business section	500
Cleveland, Superior Avenue	500

The installation covers a distance of 3,150 feet, and will involve 140 lamps of 2,000 watts each, with a rated output of 45,000 lumens each. Approximately 2,000 lumens per linear foot of street surface is provided, and the total output of light in this area will be over 6,000,000 lumens.

A novel feature is the use of a special lamp, which will in future be the standard for "down-base" burning. Owing to the large radiating surface the possibility of glass distortion owing to the excessive heat is much diminished. There is also a pocket at the peak of the lamp where material thrown off by the filament concentrates, so that minimum cut-off of the upper rays of light exists. The lamp's overall length is 16½ inches, and its maximum diameter is 6½ inches, so that it is of an exceptionally narrow type. It is burned with the base downwards, and the filament is located at rather less than one-third of the height of the bulb upwards. Novalux rippled glass globes in, so far as is known, the largest type ever used for street lighting, will be employed. The standard selected is a combination trolley-pole and lighting standard of pleasing proportions. For future capacity, either for additional street lighting or special decorative festoon lighting, 2,000 watts additional capacity is provided in each of the lamp standards.

Another interesting feature is the active part taken by occupiers of the area to be lighted in facilitating this improvement in illumination. The promotion of this installation was inaugurated by some of the leading State Street merchants, who formed the State Street Lighting Association, in co-operation with the Commonwealth Edison Company. An agreement was drawn between the association and the property owners or tenants, pledging the co-operation of the person or corporation signing it and requiring the payment of $12.54 per front foot per year for the first five years, and $7.76 per front foot per year for the second five years. The amounts subscribed on this basis are somewhat in excess of the amount required by actual costs, but provide a reserve to take care of contingencies. After sufficient frontage was secured on this basis, the association entered into a contract with the Commonwealth Edison Company for the installation, maintenance, current and lamp renewals for a 10-year period.

A Novel Photo-Electric Effect

Apart from the well-marked effects of light that are utilized in photo-electric cells, other instances of the impact of light giving rise to a more or less minute E.M.F. can be mentioned. It is known, for example, that in certain circumstances copper oxide shows this effect. It has also been recently reported by S. Schlioitch that a similar effect occurs in the case of a strip of platinum immersed in a liquid which does not attack it. Thus, with platinum in a solution of potassium chromate, or an aqueous solution of ammonia, a pressure of 12 millivolts has been developed. The chief feature is that this pressure is developed without any battery being necessary (as is, for instance, necessary with the selenium cell). When a fluctuating light impinges on this platinum combination an intermittent current, which will cause a humming note in a telephone, is produced. Such effects seem to deserve attention from physicists. It is always possible that some photo-electric phenomenon might be discovered which might ultimately form the basis of the long-sought "physical photometer."

Twenty Years of Lighting Progress

Attention may be drawn to a very useful series of papers under the above title appearing in the last issue of the *Transactions* of the Illuminating Engineering Society (U.S.A.) just received. After an introduction by Wm. J. Serrill the following subjects are dealt with: "The Science of Light and Vision" by E. C. Crittenden, "The Concepts, Units and Measurements of Illuminating Engineering Twenty Years Ago and To-day" by Dr. C. H. Sharp, "Commercial Lighting" by N. Macbeth, "Twenty Years of Industrial Lighting" by J. R. Cravath, "Twenty Years of Street Lighting Development" by P. S. Millar, "Lighting in Transportation" by G. H. Stickney, and "Progress in Lighting Education" by S. E. Doane.

Sheffield Illumination Society

SYLLABUS FOR 1927.

We have received from the Sheffield Illumination Society a syllabus for the lectures and visits for the current session which as usual covers a wide ground, both gas and electric items being well represented. The papers include addresses by Mr. J. F. Colquhoun (Hon. President) entitled "A Talk on Burners" (January 25th); by Mr. H. Girdlestone on "Light in Advertising" (March 1st); by Mr. A. Wylie on "Modern Gas Lighting and Heating" (April 13th); and by Mr. A. E. Jepson on "The Making of an Electric Lamp" (October 27th). In addition various excursions and social events have been arranged including visits to the Sheffield Telegraph Offices (March 30th); Grimesthorpe Gas Works (May 7th); and Derwent Valley Water Works (August 13th); and the Presidential Address will be delivered at the General Meeting on December 14th.

The Illuminating Engineering Movement in England (1908-1927)

(This account of the work of the Illuminating Engineering Society is based on that published in "The Illuminating Engineer" in July, 1922, which has been extended and revised and brought up to date. We are publishing this account at the request of various members, in order that those who have joined recently may have an opportunity of seeing how the movement has grown, and noting the work done in past years. This section will be reprinted in pamphlet form, and copies will be available for the use of any members who desire it for the purpose of interesting others in the Society.)

THE first decade of the twentieth century was marked by a series of advances in lamps and lighting appliances. In the field of electric lighting the flame arc, the Nernst and tantalum lamps, the mercury vapour lamp, the Moore tube, the tungsten vacuum and gas-filled lamps followed in rapid succession. Systems such as petrol air-gas lighting were making their influences felt, and substantial improvements in gas lighting and acetylene were helping to bring about a revolution in the lighting field. All these advances were being recorded in various technical journals, yet there was no common centre where all could be discussed and compared. The public became bewildered by the rapid march of progress and the variety of choice in illuminants available. Illumination had evidently become a more complex question than in the past when facilities for lighting were so much more limited.

People were also becoming conscious that, apart from these advances in lamps, there was a need for fuller knowledge as to their proper use; the circumstances most favourable to each type, and the manner in which the light yielded could be best put into service.

It was this state of things that called the Illuminating Engineering movement into existence. Developments were taking place in all parts of the world, and the first step was clearly to enlist the support of experts in various countries. As a result of visits to the Continent and the United States about 170 authorities on various aspects of illumination promised their assistance, and became correspondents of *The Illuminating Engineer*, formed in 1908, which was the first English Journal to deal exclusively with lighting by all illuminants, and to act as a centre of information on this subject.

After the Journal had been in existence a year, and had been instrumental in making the idea of "illuminating engineering" (the term adopted to cover all matters connected with the application of light in the service of mankind) more familiar, it became apparent that there existed a nucleus of people anxious to exchange views and promote a better understanding of the benefits of good illumination. Accordingly the Illuminating Engineering Society was formed in 1909, under the Presidency of the late Professor Silvanus P. Thompson, whose inaugural address contained an admirable summary of its aims and objects. Experts in the chief cities throughout the world were made corresponding members and the Society enjoyed the benefit of their experience in many ensuing discussions.

Hitherto the choice of systems of lighting had usually been regarded merely as a matter of cost, with the result that people grudged the necessary expenditure to secure adequate illumination, and did not discriminate between crude inefficient devices and those designed on scientific principles. It was not yet sufficiently realized that inadequate illumination is dear at any price, and that each application of light—whether in the home, in streets, schools, libraries, factories, etc.—requires careful study. There was, in fact, little information as to the best methods of *using* light, and the benefits of good illumination were not sufficiently appreciated.

The Illuminating Engineering Society accordingly set itself the task of providing a centre for the collection of information on all aspects of illumination and providing a platform on which representatives of different systems of lighting could meet for friendly discussion. From the outset it was apparent that there were many problems of common interest for them to consider, and that they were united in their desire to educate the public to a better recognition of the importance of good illumination.

The Society has now been in existence for more than seventeen years and the common platform it provides for discussing these various problems has been much appreciated by gas and electrical engineers. Its membership now approaches 500 and includes not only lighting experts, but architects, medical men, inspectors of factories, railway engineers and others.

Recognizing that "Light is the Cause, Illumination the Effect," and that with this *effect* all sections of the community are concerned, the Society has been instrumental in bringing together the supplier of gas and electricity, the makers of lamps and lighting appliances, and the actual *users* of light. All classes have been represented in its varied discussions, a feature of which has been the numerous joint meetings with other bodies concerned with the particular application of light under consideration. In this way the circle of those interested in the Society's work has been continually extended. Many different sections of the public have been shown that the maintenance of good illumination is of direct interest to them in their daily work. On various occasions Government Departments have also taken an active interest in the discussions of the Society.

As a result of these discussions much has been learned on the subject of illumination. The fundamental principles of good lighting are now becoming clearly established and the position is utterly different from what it was twelve years ago, when the Society commenced its work. The opportunities for discussion of all aspects of lighting have led to great technical advances. There has been great progress not only in the lamps available, but in the fittings whereby their light is usefully distributed and used to the best advantage. Simple and convenient instruments have been devised, enabling records of illumination to be obtained in buildings of all kinds, so that we now understand much better how to determine and supply the illumination required for any process, to increase the illumination where needed and to check waste where it exists. Another important step has been the increased interest taken in illumination by the medical profession and especially by opthalmologists, amongst whom the services of a Past-President of the Society, Sir John Herbert Parsons, C.B.E., F.R.S., deserve special mention.

Apart from the publicity given to the aims and objects of the Society through its discussions, and their reproduction in *The Illuminating Engineer*, the official organ of the Society, great assistance has been obtained from the daily and technical press. References to the work of the Society habitually appear in more than 100 publications. On the technical side a feature has been the formation of joint committees, by whom subjects suggested by discussions are considered in fuller detail.

In the following pages a more detailed account of the Society's work is presented. The list of papers and discussions (pp. 48-52) shows that, considering its present resources, the Society is amply fulfilling the objects for which it was created. Its influence has been beneficial alike to the public and the lighting industry. The former have been shown how to use their light to better advantage. The latter have found their efforts simplified by the growing demand for better lighting, and the appreciation of the benefits of scientific methods in applying light in the service of mankind. The time is now ripe to extend these activities on a larger scale.

In conclusion attention may be drawn to one important development since the war—the development of international aspects of illumination. The work of International Illumination, with national committees in all the chief countries, has been completely resumed. There are now Illuminating Engineering Societies in existence in the United States of America, Germany, Austria-Hungary, Holland and Japan. The Illuminating Engineering Society and its official organ, *The Illuminating Engineer*, aim at keeping members informed of all these developments and acting as a centre for information on illumination from all parts of the world.

The Work of The Illuminating Engineering Society

What The Society Has Done

INTRODUCTION.

The Illuminating Engineering Society has provided **a platform for the impartial discussion of illumination,** a friendly meeting place for architects, medical men and engineers connected with all methods of lighting. It is most important to the lighting industry that **this atmosphere of "fair play" should be maintained,** and that an independent platform for the dissemination of information on lighting should be maintained. Recommendations and demonstrations of the benefits of good lighting are much more readily accepted by the public when they proceed from a body **"with no axe to grind."**

During its 17 years of existence the Society has held 130 meetings. The **total attendance,** obtained by adding up the number of people present at each meeting, approaches 7,000, approximately 60 per cent. of whom were visitors specially interested in the various subjects discussed. Approximately 1,000 contributions have been made to the discussions.

The proceedings have been regularly reported in the official organ, THE ILLUMINATING ENGINEER, and have received a unique and widespread attention in the technical and daily press. **The Journal is habitually quoted by over 100 periodicals and daily papers,** and the movement is thus **brought to the notice of millions of people every year.**

By the efforts of the Society articles dealing with various aspects of illumination have also appeared in many special journals read in circles in which it was desired to influence in favour of good illumination.

INFLUENTIAL SUPPORT RECEIVED.

Besides appealing to the general public **the movement receives support from many distinguished engineers and scientific men.** Its **first President** was the late **Professor Silvanus P. Thompson, D.Sc., F.R.S.,** whose successors in office have been **Sir William Bennett, K.C.V.O., F.R.C.S., Surgeon to H.M. the King; Mr. A. P. Trotter,** who has been responsible for much early pioneering work in photometry and illumination; **Sir John Herbert Parsons, C.B.E., F.R.S.,** one of the most eminent ophthalmologists in this country; and the late **Mr. Chas. Wordingham, C.B.E.,** Past President of the Institution of Electrical Engineers.

The movement enlists the sympathy of those associated with pure and applied science engineering and architecture. At the Annual Dinners of the Society, for example, the Society has been honoured by the presence of, among others, the following distinguished guests:—**The Presidents of the Royal Society, the Institutions of Gas and Electrical Engineers, and the Ophthalmological Society, the Chairman of the Council of British Ophthalmologists, the Controller-General of Civil Aviation (Air Ministry), H.M. Chief Inspector of Factories, the Director of the Mines Department, the Director of the National Physical Laboratory, the Secretary of the Department for Scientific and Industrial Research, the Chairman of the Royal Society of Arts, the President of the Institution of County and Municipal Engineers, the Chairman of the Society of British Gas Industries, the President of the Electrical Contractors' Association;** whilst among other bodies and Government Departments represented may be mentioned the **Ministry of Munitions, the British Science Guild, the Royal Institute of British Architects, the London "Safety First" Council,** etc.

With many of these bodies the Society maintains intimate relations, and in order to facilitate co-operation on subjects of mutual interest an arrangement has been made by which the acting Presidents in many cases become members of Council of the Illuminating Engineering Society.

MESSAGES OF APPRECIATION.

On the occasion of the **Tenth Anniversary** of the official organ of the Society (THE ILLUMINATING ENGINEER) a series of **messages from sixty prominent scientific men,** representatives of the leading firms associated with the manufacture of lamps and lighting appliances and companies engaged in the supply of gas and electricity, besides experts interested in the hygienic and other special aspects of illumination, were received, all expressing keen sympathy and interest in the aims and objects of the Society.[1] This illustrates the wide circle to whom the movement for better illumination appeals.

The Society interests all classes. It brings the manufacturer of lighting appliances in contact with the actual user of them. For example, when discussing Library Lighting a **Joint Meeting with the Library Association** was arranged; subsequently the proceedings were reprinted by the Library Association and distributed among all its members. Similarly, when dealing with **School Lighting,** the co-operation of medical and educational authorities was secured. Subsequently **Joint Committees on School and Library Lighting** were formed. These Committees have already issued interim reports on these subjects,[2] which have received attention in most influential quarters. Already, through the work of our Society, the standard of lighting in many schools through the country is being raised.

The Illuminating Engineering Society was also instrumental in forming the **Joint Committee on the Standard Specification for Street Lighting,** on which, for the first time, delegates from the Institutions of Gas, Electrical, and Municipal and County Engineers worked together. Wishing to provide an opportunity for open discussion of this difficult subject the Committee determined to avail themselves of the impartial platform of the Illuminating Engineering Society. The paper read by Mr. A. P. Trotter on the subject attracted notice far and wide throughout the country and has already done much to raise the status of street lighting.[3]

PROGRESS IN INDUSTRIAL LIGHTING.

Since the illuminating engineering movement was started a continually increasing amount of attention has been paid to illumination in the reports of H.M. Chief Inspector of Factories. This has culminated in the **appointment by the Home Secretary of a Departmental Committee to enquire into Industrial Illumination,** which issued a most valuable and comprehensive interim report in 1915,[4] recommending that there should be statutory provision requiring: "(A) Adequate and suitable lighting in general terms in every part of a factory or workshop, and (B) giving power to the Secretary of State to make Orders defining adequate and suitable illumination for factories or workshops or for any parts thereof or for any processes carried on therein." Supplementary reports, containing recommendations on the avoidance of glare, inconvenient shadows, etc., and classifying industrial processes according to the illumination considered desirable in practice have also been issued, in 1921[5] and 1922. A general requirement of adequate and suitable lighting in factories and workshops has been embodied in the new Factory Bill now before Parliament, and legislation relating to hygienic conditions in offices, including adequate lighting, is in contemplation.

In the meantime the conditions of illumination desirable in various industries is being made the subject of careful research, the intention being to invite the co-operation of Joint Industrial Councils in deciding the requirements of the industries concerned.

In a number of the United States (New York, New Jersey, Pennsylvania, Ohio, Wisconsin, California, Oregon, etc.) codes of industrial lighting are in actual operation, and it is anticipated that the matter will be the subject of international consideration in the near future. In addition the subject of industrial lighting is receiving attention from the Department of Industrial Hygiene of the League of Nations at Geneva, with which Dr. Carozzi, a valued corresponding member of the Society, is associated.

It is understood that revision of existing legislation bearing on factory lighting is being contemplated in various countries.

ILLUMINATION AND SAFETY.

An important element in the Society's work has been its encouragement of **good illumination in the interests of safety** which is aided by the representation of the Society on the London "Safety First" Council, and on the kindred body established to deal with industry, the British Industrial "Safety First" Association. A pamphlet emphasizing the value of good lighting in the interests of safety has been issued and widely circulated by this body.

Another subject where the facilities for co-operation already established with the Council of British Ophthalmologists and other bodies concerned with the study of vision will be valuable is the **Effect of Light on the Eye.** The Society was represented on the committee formed under the auspices of the above-named Council to study the illumination of optical test-charts. It has also received most valuable assistance from this body in connection with the Joint Committee appointed at the request of the London County Council to inquire into the question of **Eyestrain in Cinemas,** which reported in 1920.[6]

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[1] ILLUM. ENG., Jan., 1918.
[2] ILLUM. ENG., July, 1913, and July, 1914.
[3] ILLUM. ENG., May and June, 1913.
[4] ILLUM. ENG., Sept., 1915.
[5] ILLUM. ENG., Oct., 1921.
[6] ILLUM. ENG., June, 1920.

ACTIVITIES DURING THE WAR.

During the war, the Society, at the request of the **Ministry of Munitions,** formed two committees to undertake researches on **radioactive self-luminous materials** having special war applications, and on the **illuminating power of flares, parachute lights,** etc.[1] Both committees conducted exhaustive experiments and issued reports which were much appreciated, and received the cordial thanks of the Ministry for their services. In connection with **Economy in Lighting** a series of recommendations to consumers was issued (with the concurrence of the Board of Trade) showing how the requirements of the Household Fuel and Lighting Order could be most readily complied with.[2] The Society and its members have also assisted by advice and experiment on many other technical matters during the war, and discussions at meetings on such subjects as **Searchlights,** the **Lighting of Rifle Ranges,** etc., have proved most helpful.

With the termination of hostilities and the resumption of more normal conditions the Society has quickly established new connections. A feature of recent activities has been the large number of occasions on which joint discussions with other bodies have been arranged. As instances may be mentioned the recent meetings devoted to **The Use of Light in Aerial Navigation**, when a joint discussion with the Royal Aeronautical Society was arranged ; the discussion on **The Lighting of Public Buildings,** when the co-operation of the Royal Institute of British Architects was invited ; and the joint meeting with the Royal Society of Medicine (Sections of Surgery and Ophthalmology) devoted to the subject of **The Use of Light in Hospitals.**

The part played by **Natural and Artificial Light in Relation to Health and Disease** has recently attracted widespread attention, and the Society accordingly arranged a joint meeting for the discussion of this subject, which was opened by Dr. C. W. Saleeby ; prominent members of the Sunlight League and other bodies interested in the subject took part in the discussion.[3] Attention may be also drawn to the numerous other discussions on aspects of lighting of special interest to certain trades and industries ; an example is afforded by the discussion on the **Lighting of Printing Works,** which was attended by members of the Joint Industrial Council for the Printing and Allied Trades, both management and labour being well represented.[4]

EDUCATION IN ILLUMINATING ENGINEERING.

Yet another discussion of special interest was that relating to **Education in Illuminating**[5] Engineering, at which numerous professors gave their experience regarding the best means of incorporating instruction in illuminating engineering in their curricula. Following this discussion a special series of lectures on various aspects of Illuminating Engineering was arranged at the Polytechnic (Regent Street), and proved a great success.

Finally, mention should be made of **The Optical Convention** held in London in 1926, which attracted widespread attention. Numerous papers on various aspects of illumination and photometry were read by members of the Society, and the opportunity was taken to emphasize the many opportunities for co-operation between the illuminating engineer and the expert in optics.

On this occasion a special exhibit in the Research Section was arranged by the Illuminating Engineering Society and attracted a considerable amount of attention.

It will be seen that the Society is continually extending its field of activities and reaching new sections of the public. It is hoped in the future to arrange for local centres in the provinces, where subjects of special interest to these localities can be discussed.

RESEARCH ON ILLUMINATION.

As a result of efforts in past years the Society has now available a considerable number of standing committees, formed to deal with a variety of special problems in illumination. The work of these committees has been inevitably restricted by lack of funds for research, but it is hoped that additional support will shortly enable the Society to extend these investigations.

Meantime a development of great importance has been the formation of the **Illumination Research Committee,** acting under the Department for Scientific and Industrial Research, which has already completed and published reports on a series of problems. In the field of standardization valuable research work is also being done by the various committees operating under the **British Engineering Standards Association.** The work of all these committees has recently been reviewed on the platform of the Illuminating Engineering Society, and an opportunity was thus afforded of making these important researches more widely known.[6] In all these supplementary investigations the Illuminating Engineering Society acts as a "liaison officer," and as members of the Society work on all these committees, interchange of experience is facilitated and overlapping of work avoided. There are numerous other committees on which the Society is represented, and which again present opportunities of initiating investigations. Among these may be mentioned the committees working under the National "Safety First" Association and the London "Safety First" Council, by whom the **relation of illumination to safety** is studied ; the committee formed by the Medical Officers of Schools Association to deal with the Ideal Classroom, which is considering **recommendations on school lighting ;** and the Standing Committee on Photometry connected with the Advisory Committee on Smoke Abatement, which has conducted various investigations in connection with the **effect of fog on visibility.**

All this work is of great moment to the lighting industry as well as to the public. Amongst the reports issued by the Illumination Research Committee that dealing with " The Relation between Illumination and Efficiency of Fine Work (Type-setting by Hand) " is of special consequence in showing how better lighting leads to improved accuracy and speed of work. It is obviously essential that data on this subject should be forthcoming from a **committee of high scientific standing and representative composition.** In this case the results were rendered specially valuable by the co-operation of the Joint Industrial Council for the Printing Trades of the United Kingdom, on which management and labour are alike represented.

INTERNATIONAL DEVELOPMENTS.

From the commencement of the Society's work it has aimed at an **international connection** in order that members may be kept abreast of progress in illumination in various parts of the world. Prior to the war the Society was frequently represented at international congresses, amongst which may be mentioned :—

The International Congress on Industrial Hygiene (Brussels, 1910).
The International Hygiene Congress (Dresden, 1911).
The International Electrical Congress (Turin, 1911).
The First International Congress for the Prevention of Industrial Accidents (Milan, 1912).
The Fourth International Congress of School Hygiene (Buffalo, 1913).
The Annual Congress of the Royal Institute of Public Health (Paris, 1913 ; Brussels, 1920).
The First Technical Session of the International Illumination Commission (Paris, 1921).

During the war such activities were naturally interrupted. But opportunities of attending congresses where useful work can be done now present themselves once more. The Society was represented at the Congress of the Royal Institute of Public Health, held in Paris in May, 1920, when industrial lighting and other topics of interest to illuminating engineers were discussed. A most important event was the holding of the **First Technical Session of the International Illumination Commission** held in Paris during July 4-8, 1921, when a series of papers on various aspects of illumination and photometry was presented, and important resolutions passed.

At the second meeting, held in Geneva in 1925, a feature was the great variety of papers presented, and the inclusion in the programme of various communications dealing mainly with the practical applications of illuminating engineering. It is expected that at the next gathering all nations (including ex-enemy countries) will be represented, so that the international treatment of illumination will be completely resumed.

There have also been opportunities of visiting France and Germany, Belgium, Holland, Roumania and Czecho-Slovakia, and interesting authorities in illuminating engineering. In this way an interest in the subject may be kindled in many parts of the world.

Meantime the Illuminating Engineering Societies in various countries have been actively at work. The Society in the United States recently celebrated its twentieth anniversary. There are now Illuminating Engineering Societies also in existence in Germany, Austria-Hungary, Holland and Japan. The British Illuminating Engineering Society was represented at the inaugural luncheon of the Dutch Society held in Dusseldorf in 1926, and this Society appears to be making rapid progress with the assistance of its energetic secretary, Dr. N. A. Halbertsma.[7]

In many respects the Illuminating Engineering Society in this country is specially well fitted to act as a link between these various societies. An important step in this direction was taken in 1925, in the issue of its journal (**The Illuminating Engineer**) in a **revised and extended form.** A special feature is being made of international connections which enable illuminating engineers in this country to be kept informed of developments abroad, and promote the interchange of information and experience between experts in different countries.

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[1] ILLUM. ENG., Nov. and Dec., 1918.
[2] ILLUM. ENG., May and July, 1918.
[3] ILLUM. ENG., July, 1925.
[4] ILLUM. ENG., Feb. 1923.
[5] ILLUM. ENG., May, 1923.
[6] ILLUM. ENG., March, 1926.
[7] ILLUM. ENG., Aug. and Nov., 1926.

LIST OF PAPERS READ BEFORE
The Illuminating Engineering Society

(Founded in London, 1909)

1909—1927

(The numbers in parentheses at the end of each reference indicates the number of persons taking part in the discussion.)

1909

Nov. 18 INAUGURAL ADDRESS. By PROF. SILVANUS P. THOMPSON.

1910

Jan. 11 & Feb. 15 GLARE, ITS CAUSES AND EFFECTS. By J. HERBERT PARSONS.
Discussed by :—
Great Britain—Dr. F. W. Edridge Green, Dr. F. Gans, Dr. J. Kerr, Dr. W. Ettles, Dr. T. M. Legge, Dr. W. M. Bayliss, P. J. Waldram, A. P. Trotter, J. H. Agar Baugh, J. S. Dow, W. R. Cooper, W. M. Mordey, Haydn T. Harrison, V. H. Mackinney, L. Gaster, Dr. S. P. Thompson, Dr. E. H. Nash, Dr. W. Ettles, Prof. G. J. Burch.
Abroad—Dr. K. Stockhausen (Dresden), Prof. L. Weber (Kiel), Dr. Corsepius (Cologne), Dr. L. Bell (Boston), Dr. E. P. Hyde (Cleveland), Prof. R. Ulbricht (Dresden), Dr. L. Bloch (Berlin), M. Lauriol (Paris), Prof. S. A. Rumi (Genoa), Dr. W. H. Seabrook (New York), Dr. E. O. Sisson (Denver), Dr. W. Voege (Hamburg), Dr. H. Krüss (Hamburg), Prof. H. Strache (Vienna), H. Prenger (Cologne), Dr. H. Lux (Berlin), Prof. A. Grau (Vienna), Messrs. Körting & Mathiesen (Berlin), C. H. Williams (Boston) (19).

Mar. 15 & April 14 THE MEASUREMENT OF LIGHT AND ILLUMINATION (General Discussion).
Discussed by :—
Great Britain—Prof. A. E. Vernon Harcourt, Dr. J. A. Fleming, A. P. Trotter, C. C. Paterson, Dr. W. E. Sumpter, W. J. Liberty, Prof. J. T. Morris, J. S. Dow, L. Wild, J. G. Clark, Haydn T. Harrison, P. J. Waldram, K. Edgcumbe, L. Gaster, W. R. Cooper, G. F. Boxall (16).
Abroad—Dr. K. Stockhausen (Dresden), Dr. L. Bell (Boston), Dr. C. H. Sharp (New York), G. H. Stickney (Schenectady), F. Lauriol (Paris), Prof. A. Blondel (Paris), Dr. Corsepius (Cologne), W. J. Cady (New York), A. A. Wohlauer (New York), N. Macbeth (New Jersey) (10).

April 14 THE DIRECT MEASUREMENT OF THE TOTAL LIGHT EMITTED FROM A LAMP. By DR. W. E. SUMPNER. (6)

Nov. 8 RECENT PROGRESS IN AND THE PRESENT STATUS OF GASLIGHTING. By F. W. GOODENOUGH. (13)

Dec. 9 RECENT PROGRESS IN ELECTRIC LIGHTING. By DR. W. E. MARCHANT.
NOTE ON THE BLACKENING OF TUNGSTEN LAMPS. By G. W. HOWE. (16)

1911

Jan. 16 & Jan. 31 THE ARTIFICIAL LIGHTING OF LIBRARIES. By J. DUFF BROWN, L. S. JAST, J. DARCH. (25)
(*Joint Meeting with the Library Association.*)

Feb. 16 THE NATURAL LIGHTING OF SCHOOLS. By DR. J. KERR.
THE ARTIFICIAL LIGHTING OF SCHOOLS. By DR. N. BISHOP HARMAN. (25) (*Joint Meeting with the Association of Medical Officers in Schools, the London Teachers' Association, and the Association of Technical Institutions.*)

April 24 INTERIOR ILLUMINATION AND THE REFLECTING POWER OF WALLS AND CEILINGS. By HAYDN T. HARRISON and P. J. WALDRAM. (12)

Nov. 17 NOTES ON THE DESIGN OF MOTOR-CAR HEADLIGHTS. By DR. H. R. B. HICKMAN. (10)

Dec. 19 LIGHTING OF RAILWAY STATIONS AND GOODS YARDS. By HAYDN T. HARRISON. (15)

1912

Jan. 16 COLOUR DISCRIMINATION BY ARTIFICIAL LIGHT. By T. E. RITCHIE. (15)

Feb. 20 SHOP LIGHTING BY ELECTRICITY. By N. W. PRANGNELL.
SHOP LIGHTING BY GAS. By A. E. BROADBERRY. (16)

Mar. 19 ILLUMINATION OF PRINTING WORKS BY ELECTRICITY. By J. ECK.
ILLUMINATION OF PRINTING WORKS BY GAS. By F. W. GOODENOUGH. (11)

April 15 PRIVATE HOUSE LIGHTING BY ELECTRICITY. By W. R. RAWLINGS.
PRIVATE HOUSE LIGHTING BY GAS. By W. H. Y. WEBBER. (12)

Nov. 19 RECENT PROGRESS IN ILLUMINATING ENGINEERING. By L. GASTER.
A NEW ILLUMINATION PHOTOMETER. By HAYDN T. HARRISON.
PHOTOGRAPHY IN ILLUMINATING ENGINEERING. By J. S. DOW.
APPARATUS TO ILLUSTRATE REFLECTIONS FROM WALLS AND THE CEILING. By PROF. W. C. CLINTON. (12)

Dec. 3 MODERN METHODS OF INDIRECT LIGHTING. By F. W. WILLCOX and H. C. WHEAT. (14)

1913

Jan. 14 ACETYLENE LIGHTING. By C. HODDLE.
PETROL-AIR GAS LIGHTING. By E. SCOTT SNELL. (15)

Feb. 18 SOME NOTES ON THE USE OF SHADES AND REFLECTORS. By J. G. CLARK and V. H. MACKINNEY. (14)

Mar. 11 THE CENTENARY OF GAS LIGHTING AND ITS HISTORICAL DEVELOPMENT. By W. J. LIBERTY. (5)

April 15 & April 29 STANDARD CLAUSES FOR INSERTION IN A SPECIFICATION OF STREET LIGHTING. By A. P. TROTTER.
Discussed by :—
Great Britain—W. H. Patchell, F. W. Goodenough, Haydn T. Harrison, R. Watson, J. G. Clark, F. Thorp, K. Edgcumbe, J. Darch, H. T. Wilkinson, Prof. J. T. Morris, J. W. Bradley, F. Bailey, E. Allen, Roger T. Smith, W. R. Cooper, J. Abady, L. Gaster, N. W. Prangnell, S. L. Pearce, H. A. Ratcliff, J. G. Clark, J. S. Dow, W. J. Liberty (23).
Abroad—Dr. L. Bloch (Berlin), Dr. L. J. Terneden (Amsterdam), Prof. H. Strache (Vienna), Prof. S. A. Rumi (Genoa), Dr. L. Bell (Boston), L. B. Marks (New York), Dr. C. H. Sharp (New York), P. S. Millar (New York) (8).

Nov. 18 REPORT OF PROGRESS DURING VACATION. By L. GASTER.
ILLUMINATION AT THE NATIONAL GAS EXHIBITION. By F. W. GOODENOUGH.
SOME NOTES ON THE FOURTH INTERNATIONAL CONGRESS OF SCHOOL HYGIENE. By DR. JAMES KERR.
SHADOWS BY NATURAL AND ARTIFICIAL LIGHT. By J. S. DOW and V. H. MACKINNEY. (5)
THE IMPORTANCE OF DIRECTION, QUALITY AND DISTRIBUTION OF LIGHT. By M. LUCKIESH.

Dec. 16 SOME PROBLEMS IN DAYLIGHT ILLUMINATION. By P. J. WALDRAM.

1914

Jan. 15 Discussion of above paper :—
Great Britain—G. Widdows, Dr. J. Kerr, J. S. Dow, F. R. Farrow, Dr. E. H. Nash, A. P. Trotter, W. C. Clinton, H. L. Dunstall, C. C. Paterson, P. L. Marks, W. H. Webb, Dr. F. Gans, J. S. Dow, V. H. Mackinney, L. Gaster, T. E. Ritchie, L. Warren, P. J. Waldram (18).
Abroad—Prof. L. Weber (Kiel), Dr. F. Pleier (Karlsbad), Dr. L. Burgerstein (Vienna), Dr. F. Altschul (Prag), Dr. Erisman (Zurich), Dr. Kaz (St. Petersburg), Prof. Richtmeyer (Ithaca, U.S.A.), Dr. Max Gruber (Munich) (8).

Feb. 17 THE LIGHTING OF PICTURE GALLERIES AND ART STUDIOS. By PROF. SILVANUS P. THOMPSON. (15)

Mar. 17 A COMPARISON OF ESTIMATED AND OBSERVED VALUES OF ILLUMINATION IN SOME LIGHTING INSTALLATIONS. By W. C. CLINTON. (13)

April 7 THE LIGHTING OF RAILWAY CARRIAGES AND OTHER PUBLIC VEHICLES. (Discussion.) (9)

May 21 THE NOMENCLATURE AND DEFINITION OF PHOTO-MAGNITUDES AND UNITS. By A. P. TROTTER.

Discussed by :—

Great Britain—Dr. S. P. Thompson, C. C. Paterson, Haydn T. Harrison, F. W. Goodenough, W. C. Clinton, E. Allen, K. Edgcumbe, J. T. Morris, W. J. A. Butterfield, J. Darch, W. J. Liberty, V. H. Mackinney, A. V. Belltell, Dr. A. Schuster, J. S. Dow, W. R. Cooper, J. W. T. Walsh (17).

Abroad—Dr. L. Bell (Boston), Prof. A. Blondel (Paris), Prof. Dr. H. Bunte (Karlsruhe) (3).

Dec. 1 ILLUMINATING ENGINEERING IN WAR TIME. By L. GASTER. (10)

1915

Jan. 19 SEARCHLIGHTS, THEIR SCIENTIFIC DEVELOPMENT AND PRACTICAL APPLICATION. By P. G. LEDGER. (15)

Feb. 16 THE DEVELOPMENT AND DESIGN OF LIGHTING FIXTURES IN RELATION TO ARCHITECTURE, INTERIOR DECORATION AND ILLUMINATION. By F. W. THORPE. (17)

Mar. 16 THE RATING AND GRADING OF LAMPS AND THE BEST METHODS OF SPECIFYING THEIR ILLUMINATING VALUE. By F. W. WILLCOX. (20)

April 27 VISIBILITY : ITS PRACTICAL ASPECTS. By C. C. PATERSON and B. P. DUDDING. (11)

May 17 SOME POINTS IN CONNECTION WITH THE LIGHTING OF RIFLE RANGES. By A. P. TROTTER.

Discussed by :—

A. Blok, A. Schamasch, P. J. Waldram, H. Brazil, Col. Gaitskell Burr, H. Freak, W. J. Bassett, G. Herbert, the Commandant of the Royal School of Musketry, Hythe, F. Bailey, S. G. Coram, T. B. Pickard, J. G. Clark, W. Ettles, the Commandant of the Royal Marines Depot, Deal, J. S. Dow, Frank West (Hon. Secretary of the Rifle Club at the India Office) (17).

Nov. 23 NOTES ON THE FIRST REPORT OF THE DEPARTMENTAL HOME OFFICE COMMITTEE ON LIGHTING IN FACTORIES AND WORKSHOPS. By L. GASTER. (12)

Dec. 10 RECENT DEVELOPMENTS IN ELECTRIC INCANDESCENT LAMPS IN RELATION TO ILLUMINATING ENGINEERING. By PROF. J. T. MCGREGOR MORRIS. (8)

1916

Jan. 11 SOME PRINCIPLES IN INDUSTRIAL LIGHTING. By J. S. DOW. (12)

Feb. 22 SOME FUTURE POSSIBILITIES IN THE DESIGN OF INSTRUMENTS FOR MEASURING ILLUMINATION. (17)

Mar. 31 SOME ASPECTS OF THE DESIGN AND USE OF GLASSWARE IN RELATION TO NATURAL AND ARTIFICIAL ILLUMINATION. By S. B. LANGLANDS (21)

May 9 INTERIM REPORT OF THE COMMITTEE ON RESEARCH.

Dec. 15 SOME EVENTS DURING THE VACATION WITH SPECIAL REFERENCE TO WAR ECONOMIES IN LIGHTING. By L. GASTER. (7)

1917

Jan. 16 THE LUMEN AS A MEASURE OF ILLUMINATING POWER. By PROF. J. T. MCGREGOR MORRIS, F. W. WILLCOX. (15)

Feb. 20 THE EFFECT ON THE EYE OF VARIOUS DEGREES OF BRIGHTNESS AND CONTRAST. By DR. JAMES KERR.

(*The Cinema Commission of Inquiry was represented at this discussion.*)

Discussed by :—

Sir William Bennett, Dr. Ernest Clarke, M.P., F.R.C.S., N. Bishop Harman, Colin N. Bennett, E. G. Kennard, Dr. C. W. Kimmins (Member of the Cinema Commission of Inquiry); L.C.C. Chief Inspector of Schools, A. E. Newbould (Member of the Cinema Commission of Inquiry), F. W. Goodenough, Dr. F. W. Edridge Green, E. T. Swinson, Lieut. S. R. Mullard, R.N.V.R., Mrs. M. A. Cloudesley, Brereton, A. Cunnington, J. G. Clark, A. P. Trotter, J. W. Barker, J. S. Dow, L. Gaster. (18)

Mar. 22 FLUORESCENCE AND PHOSPHORESCENCE AND THEIR USE TO PRODUCE LUMINOUS EFFECTS. By F. HARRISON GLEW, J. S. DOW, ARTHUR BLOK. (4)

May 15 ECONOMIES IN LIGHTING IN RELATION TO FUEL SAVING. (5)

Dec. 18 PRESIDENTIAL ADDRESS. By A. P. TROTTER.

1918

Jan. 15 TEN YEARS OF ILLUMINATING ENGINEERING. ITS LESSONS AND FUTURE PROSPECTS. By L. GASTER. (6)

Feb. 26 A SURVEY OF METHODS OF DIRECTING AND CONCENTRATING LIGHT. By LIEUT.-COMMANDER HAYDN T. HARRISON. (13)

April 16 LIGHT AND VISION, THE PHYSIOLOGY OF THE RETINA. By PROF. W. M. BAYLISS.

(*Co-operation of Physiologists and Ophthalmists specially invited.*)

Discussed by :—

E. Treacher Collins (President of the Ophthalmological Society), Sir J. Herbert Parsons, Dr. F. W. Edridge Green, Dr. James Kerr, Lieut.-Col. R. H. Elliott, Dr. J. F. Crowley, S. Taylor, R. P. Howgrave Graham, A. P. Trotter, L. Gaster, W. C. Clinton, J. S. Dow (12).

May 14 RECOMMENDATIONS ON ECONOMY IN LIGHTING. (9)

Dec. 19 PHOTOMETRIC APPARATUS FOR MEASURING THE ILLUMINATING VALUE OF FLUCTUATING SOURCES OF HIGH CANDLE-POWER (Flares, Parachute Lights, etc.). By A. P. TROTTER.

SOME PHOTOMETRIC TESTS OF THE BRIGHTNESS OF RADIOACTIVE SELF-LUMINOUS MATERIALS. By W. C. CLINTON.

Discussed by :—

W. C. Clinton, J. S. Dow, C. C. Paterson, Capt. G. Gray (M.O.M. Chemical Warfare Dept.), F. F. S. Bryson (M.O.M. Optical Munition and Glassware Supply), F. Harrison Glew, J. W. T. Walsh, A. Blok, Mrs. Hertha Ayrton, L. Gaster, A. L. Landau (11).

1919

Jan. 21 MODERN PRACTICE IN OFFICE LIGHTING. By A. Wise. (11)

Feb. 25 SOME NOTES ON RAILWAY LIGHTING AND ITS MAINTENANCE. By A. CUNNINGTON.

(*Co-operation of Railway Engineers specially invited.*)

Discussed by :—

Haydn T. Harrison, J. H. Haigh (Lancashire and Yorkshire Railway), A. H. Stevens (London and North-Western Railway), P. Whysall (Underground Electric Railways Ltd.), H. Perkin (Great Central Railway), F. W. Goodenough, A. Wise, H. E. Roberts (South-Eastern and Chatham Railway), A. P. Trotter, L. Gaster, H. I. Bond (London and South-Western Railway), N. W. Prangnell, E. S. D. Moore (London and North-Western Railway), M. Macdonald (Great Western Railway), C. R. Williams (15).

April 8 THE ART OF STAGE LIGHTING. By J. B. FAGAN (Royal Court Theatre).

(*Meeting arranged in co-operation with the "Critics' Circle" of the Institute of Journalists.*)

Discussed by :—

William Archer, T. J. Digby, G. E. Morrison (Chairman, "Critics' Circle"), N. R. Booth, Mrs. K. Searle, N. McDermott (Everyman Theatre), J. W. T. Walsh, Howgrave Graham, Lane Crawford (Britannia Theatre), W. G. Raffé, J. Darch, A. P. Trotter, L. Gaster, G. A. Applebee, J. S. Dow, Gordon Craig. (16).

May 30 THE GASFILLED LAMP AND ITS EFFECT ON ILLUMINATING ENGINEERING. By F. W. WILLCOX. (15)

(*Meeting arranged in co-operation with the Electric Contractors' Association, the Association of Supervising Electricians, and the Association of Engineers-in-charge.*)

June 24 STREET-LIGHTING RECONSTRUCTION PROBLEMS. By L. GASTER. (7)

Nov. 25 Introductory Meeting to Session :—

LAMBERT AND PHOTOMETRY. By A. P. TROTTER.

REPORT OF COMMITTEE ON PROGRESS IN LAMPS AND LIGHTING APPLIANCES.

THE SHERINGHAM DAYLIGHT. By L. C. MARTIN.

NEW FORM OF POINTOLITE LAMPS. By P. FREEDMAN.

A NEW FORM OF ILLUMINATION PHOTOMETER. By HAYDN T. HARRISON.

Dec. 16 THE ART OF CAMOUFLAGE. By CAPT. W. A. HOWELLS, O.B.E. (6)

1920

Jan. 27 COLOUR MATCHING BY NATURAL AND ARTIFICIAL LIGHT. By L. C. MARTIN.

Discussed by :—

A. E. Bawtree, Miss F. E. Baker, G. Herbert, A. S. Jennings, Dr. J. F. Crowley, J. H. Sutcliffe, Wm. Wallace, F. E. Lamplough, A. P. Trotter, G. Sheringham, L. Gaster, R. Lessing, E. R. Grills, Prof. W. M. Gardner, D. Patterson, M. L. M. Luckiesh, N. Macbeth, and J. S. Dow (18).

Feb. 24 LIGHTING CONDITIONS IN MINES WITH SPECIAL REFERENCE TO THE EYESIGHT OF MINERS. By DR. T. LISTER LLEWELLYN, DR. H. S. ELWORTHY.
(Co-operation of Medical Profession, Managers of Collieries, etc.)
Discussed by :—
Dr. J. S. Haldane, R. Armitage, M.P., Dr. F. Shufflebotham, E. Fudge (Secretary, Home Office Committee on Miners' Lamps), E. A. Hailwood, J. George, Dr. D. L. Davis, T. Harrison Butler, Dr. C. F. Harford, V. V. Pass, G. H. Pooley, Bernard Cridland, A. L. Whitehead, N. Bishop Harman, L. Gaster, Sir John H. Parsons (Chairman), Sir Geo. Berry, Sir Josiah Court, Dr. Geo. Mackay, S. Nettleton, A. P. Welch, C. S. Percival, Dr. J. A. Wilson, Dr. L. Buchanan, H. F. Joel, Dr. M. Stassen (26).

Mar. 30 MOTOR-CAR HEADLIGHTS IN RELATION TO TRAFFIC REQUIREMENTS. By J. W. T. WALSH. (18)

April 20 THE ARTIFICIAL LIGHTING OF CHURCHES. By J. DARCH. (9)

May 11 RECENT DEVELOPMENTS IN TYPES OF PORTABLE CINEMA OUTFITS. By CAPT. J. W. BARBER, C.B.E.
Discussed by :—
Dr. James Kerr, F. R. Goodwin (President of the Cinematograph Exhibitors' Association), Major A. Cooper-Key (Chief Inspector of Explosives, Home Office), E. Ridley (London Fire Brigade), J. C. Elvy, A. Blok, A. L. Roberts, L. Gaster, J. S. Dow (8).

Dec. 14 Introductory Meeting to the Session devoted to Reports, Progress and Novelties in Illumination.
REPORTS ON PROGRESS IN GAS AND ELECTRIC LAMPS AND LIGHTING APPLIANCES.
SMALL GASFILLED LAMPS WITH OPAL BULBS. By E. STAINES.
DEVELOPMENTS IN THE SHERINGHAM DAYLIGHT. By MAJOR A. KLEIN.
NEON LAMPS FOR LOW-VOLTAGE CIRCUITS. By J. S. DOW.
A FOOT-CANDLE METER. By J. S. DOW.
THE LIGHTING OF RAILWAY TIME-TABLES. By A. CUNNINGTON.

1921

Jan. 18 THE USE AND ABUSE OF LIGHT FOR KINEMA FILM PRODUCTION. By J. C. ELVY.
(In co-operation with Managers of Kinema Studios, Kinema Experts, etc.)
Discussed by :—
Sir John H. Parsons, W. Day, A. G. Way, F. J. Hawkins, H. A. Carter, R. E. Boardman, Rt. Hon. G. H. Roberts, M.P., A. Lugg, Capt. P. Kimberley, Capt. J. W. Barber, C. Bennett, H. M. Lomas, S. Rowson, P. King, T. W. Armes, L. Gaster, Sir Wm. M. Bayliss, W. E. Bush, W. Krause (19).

Feb. 24 THE USE OF LIGHT AS AN AID TO PUBLICITY (15) :—
(*a*) THE SHOW WINDOW AND SPECTACULAR LIGHTING. By CAPT. E. STROUD.
(*b*) ILLUMINATED SIGNS. By E. C. LEACHMAN.

Mar. 17 MOTOR-CAR HEADLIGHTS : IDEAL REQUIREMENTS AND PRACTICAL SOLUTIONS. By MAJOR GARRARD. (11)

April 26 SHIP LIGHTING IN RELATION TO SAFETY, COMFORT AND EFFICIENCY. By W. J. JONES.
(Co-operation of representatives of the Admiralty, the Royal Navy, and the Mercantile Marine Service Association invited.)
Discussed by :—
F. P. Fletcher (Elec. Eng. Dept., Admiralty), S. H. Callow, Capt. Colin Nicholson (Mercantile Marine Service Association), J. W. Elliott, Lieut.-Com. J. W. A. Waller, R.N., Capt. Collier, P. J. Waldram, Capt. A. L. Taylor, C. L. Matthews, C. E. Greenslade, J. Freeth, A. M. Currie, C. H. Wordingham, L. Gaster (14).

May 31 THE USE OF LIGHT AS AN AID TO VARIOUS GAMES AND SPORTS. By J. S. DOW. (7)

Nov. 15 Introductory Meeting to the Session devoted to Reports, Progress, and Novelties in Illumination.
REPORT ON PROGRESS IN LAMPS AND LIGHTING APPLIANCES.
FLUORESCENCE OF GEMS BY ULTRA-VIOLET LIGHT. By W. J. JONES.
NEW TYPES OF INDUSTRIAL LIGHTING REFLECTORS. By G. CAMPBELL.
IMPROVEMENTS IN THE SHERINGHAM DAYLIGHT. By S. H. GROOM.
CHANCE'S DAYLIGHT GLASS. By F. E. LAMPLOUGH.
THE GRUBBE "NON-DAZZLE" HEADLAMP. By J. ARMSTRONG.
THE WHITEHEAD HEADLIGHT. By W. J. JONES.
DISCHARGE (NEON) LAMPS. By H. A. CARTER.
DEVELOPMENTS IN LUMINOUS SIGNS. By E. T. RUTHVEN MURRAY.
LUMINOR SIGNS. By MAJOR W. C. AMCOTTS.

Dec. 13 RECENT PROGRESS IN GAS LIGHTING IN RELATION TO ILLUMINATING ENGINEERING. By W. J. SANDEMAN.
Discussed by :—
A. E. Broadberry, A. Cunnington, A. H. Stevens, F. W. Goodenough, L. Gaster, P. J. Waldram, A. E. Fry, W. J. Jones, A. J. Whyte, L. M. Tye (10).

1922

Jan. 31 THE USE OF LIGHT AS AN AID TO AERIAL NAVIGATION. By LT.-COL. BLANDY, D.S.O.
(Joint Meeting with the Royal Aeronautical Society.)
Discussed by :—
Major-Gen. Sir Frederick Sykes, G.B.E., K.C.B., C.M.G. (Controller-General of Civil Aviation, Chairman), Col. Mervyn O'Gorman, Major-Gen. Sir Sefton Brancker, K.C.B., Sir Acton Blake (Deputy-Master of Trinity House), Haydn T. Harrison, T. E. Ritchie, Col. Gold (Meteorological Dept., Air Ministry), P. J. Waldram, A. G. Watson, Lt.-Col. C. H. Sylvester Evans, Major J. P. Ashley Waller (11).

Feb. 28 INDUSTRIAL LIGHTING; IDEAL REQUIREMENTS (LEGISLATIVE AND OTHERWISE) AND PRACTICAL SOLUTIONS. By L. GASTER. (10)

Mar. 27 LIGHTING OF PUBLIC BUILDINGS. By DR. E. H. RAYNER, J. W. T. WALSH, and H. BUCKLEY.
(Joint Discussion arranged with the Royal Institute of British Architects.)
Discussed by :—
Capt. W. J. Liberty, F. A. Llewellyn (H.M. Office of Works), P. J. Waldram, Major H. C. Gunton (Post Office, Eng. Dept.), C. A. Baker (Elec. Engineer, L.C.C.), G. Campbell, Haydn T. Harrison, A. Cunnington, A. G. Ramsey (H.M. Office of Works), A. C. Pallot (H.M. Office of Works), C. H. Burt, R. Langton Cole, A. E. Bullock, J. W. Jones (14).

April 27 THE USE OF LIGHT IN HOSPITALS. By J. DARCH.
(Joint Meeting with the Royal Society of Medicine—Sections of Surgery and Ophthalmology.)
Discussed by :—
C. C. Choyce, W. T. Holmes Spicer, Conrad Beck, J. B. Reiner, A. Wilson, F. C. Raphael, J. W. Elliott, W. J. Jones, E. W. Johnston, L. Gaster, Major J. P. Ashley Waller (11).

May 31 Annual Meeting. Presentation of Council's Report for Session and Address by the President (SIR JOHN HERBERT PARSONS, C.B.E., F.R.S.).

Nov. 14 Opening Meeting devoted to Reports of Progress and Novelties in Illumination.
NOTES ON EVENTS DURING THE VACATION. By L. GASTER.
REPORT OF THE COMMITTEE ON PROGRESS IN ELECTRIC LAMPS AND LIGHTING APPLIANCES.
EXHIBITS ILLUSTRATING PROGRESS IN ILLUMINATING ENGINEERING :—
THE "TUCK" PHOTOMETER. By CAPT. E. STROUD.
THE HOLOPHANE "FILTERLITE." By CAPT. E. STROUD.
NEW TYPES OF HOSPITAL INSPECTION LAMPS. By J. B. REINER.
THE CEAG PILLARLESS MINERS' LAMP. By W. PLUMMER.
THE BLINKING EFFECT OF NEON GASFILLED LAMPS. By S. O. PEARSON.
LIGHTING OF THE NEW PORT OF LONDON BUILDING. By CAPT. W. J. LIBERTY.
DUSTPROOF BOWL FITTINGS.
PROJECTOR LAMPS. By W. J. JONES.
"INTERNALITE" ILLUMINATED SIGNS. By E. T. RUTHVEN MURRAY.
IMPREGNATED SILK SHADES. By CHAS. SELZ.

Dec. 12 RECENT DEVELOPMENTS AND MODERN REQUIREMENTS IN STREET LIGHTING. By HAYDN T. HARRISON.

STREET LIGHTING IN RELATION TO SAFETY. By L. GASTER.

(Joint Meeting with the Institutions of Gas and Electrical Engineers and the Institution of County and Municipal Engineers.)

Discussed by :—

Dr. Clayton Sharp (Past-President of the Illuminating Engineering Society, U.S.A.), Mr. Frank Bailey, Capt. W. J. Liberty, Mr. S. B. Langlands (Public Lighting Inspector, City of Glasgow), Mr. J. G. Clark, Mr. R. Davison (City Lighting Dept., Newcastle-on-Tyne), Capt. H. L. Thomson, Capt. E. Stroud, A. Cunnington, J. Eck, W. J. Jones (11).

1923

Jan. 16 THE NEED FOR SUITABLE TRAINING IN ILLUMINATING ENGINEERING. By C. E. GREENSLADE and J. E. S. WHITE.

Discussed by :—

Dr. F. T. Chapman, A. Blok, L. Gaster, Prof. French (Leeds University), S. Skinner (Principal of Chelsea Polytechnic), P. J. Waldram, Dr. J. Kerr, Prof. E. W. Marchant (Liverpool University), Dr. L. C. Martin (Imperial College of Science), Prof. J. W. Whittaker (University College, Nottingham) (10).

Feb. 20 THE PROJECTION OF LIGHT. By W. J. JONES and E. A. MARX.

Mar. 27 WINDOW DESIGN AND THE MEASUREMENT AND PREDETERMINATION OF DAYLIGHT ILLUMINATION. By P. J. WALDRAM and J. M. WALDRAM.

April 24 SOME PROBLEMS IN THE LIGHTING OF PRINTING WORKS. By L. GASTER.

Discussed by :—

F. W. Bridges, The Rt. Hon. C. W. Bowerman, A. E. Goodwin and A. E. Holmes (Joint Secretaries of the Joint Industrial Council of the Printing and Allied Trades), J. R. Riddel (Principal of the London School of Printing), E. Pontis, G. Isaacs (Secretary of the National Society of Operative Printers and Assistants), G. Mascard, J. G. Clark, G. Campbell, P. J. Waldram, F. E. Lamplough, P. Walmsley, J. Eck (13).

May 24 Annual Meeting.

THE SPECTROPHOTOMETRIC COMPARISON OF ARTIFICIAL DAYLIGHT WITH NATURAL NORTH SKY LIGHT. By P. R. ORD.

INTERMITTENT ILLUMINATION IN INDUSTRY (WITH SPECIAL REFERENCE TO ITS USE FOR THE EXAMINATION OF MOVING BODIES). By DR. J. F. CROWLEY.

Nov. 13 Opening Meeting devoted to Reports of Progress and Novelties in Illumination :—

NOTES ON EVENTS DURING THE VACATION. By L. GASTER.

REPORT OF COMMITTEE ON PROGRESS IN ELECTRIC LAMPS AND LIGHTING APPLIANCES.

RAILWAY LIGHTING. By A. CUNNINGTON.

PROGRESS IN GAS LIGHTING. By J. G. CLARK.

DEVELOPMENTS IN GAS FITTINGS. By PHILIP SUGG.

NEW FORMS IN ELECTRIC LAMPS. By L. E. BUCKELL.

THE IRWIN COLOUR FILTER SYSTEM. By MISS BEATRICE IRWIN.

HOLOPHANE COLOUR UNITS. By E. STROUD.

POINTOLITE LAMPS FOR ALTERNATING CURRENT. By E. GREETHAM.

THE CRAFTSMAN MOTOR HEADLIGHT. By A. B. WALLIS.

ILLUMINATED SIGNS. By E. T. RUTHVEN MURRAY.

THE APPLICATION OF SCIENTIFIC ILLUMINATION IN PRACTICE. By G. HERBERT and R. A. IVES.

1924

Jan. 22 CO-ORDINATION OF RESEARCH IN ILLUMINATING ENGINEERING AND SOME PRACTICAL APPLICATIONS. By J. S. DOW.

Feb. 19 SOME NOTES ON TRACTION LIGHTING BY ELECTRICITY. By J. F. CAINE and E. A. MARX (Jr.).

Mar. 21 THE USE OF LIGHT FOR OUTDOOR ADVERTISING. By G. P. GARBETT.

THE USE OF LIGHT IN SHOPS, SHOW WINDOWS, AND FOR DISPLAY PURPOSES. By MISS M. PARTRIDGE.

April 28 SOME NOTES ON GAS LIGHTING IN THE TEXTILE INDUSTRY. By E. L. OUGHTON.

SOME PROBLEMS IN THE DAYLIGHT LIGHTING OF TEXTILE FACTORIES. By P. J. WALDRAM.

May 26 Annual Meeting.

Aug. 12 Conference arranged by the Illuminating Engineering Society at the British Empire Exhibition :—

THE BEST MEANS OF PROMOTING PUBLIC APPRECIATION OF THE BENEFITS OF GOOD LIGHTING. By L. GASTER.

ILLUMINATION OF HIGHWAYS, FROM THE MOTORISTS' POINT OF VIEW. By E. H. FRYER.

SOME NOTES ON THE LIGHTING OF THE BRITISH EMPIRE EXHIBITION. By (1) HAYDN T. HARRISON (Electric) and (2) G. L. JENNINGS (Gas).

Nov. 18 NOTES ON EVENTS DURING THE VACATION. By L. GASTER.

PROGRESS IN ELECTRIC LAMPS AND LIGHTING APPLIANCES.

A NEW FORM OF MOTOR HEADLIGHT. By MAJOR A. GARRARD.

A NEW STREET-LIGHTING LANTERN. By T. E. RITCHIE.

TYPES OF COLOUR-SPRAYED LAMPS. By L. E. BUCKELL.

NEW FORMS OF INDUSTRIAL LIGHTING REFLECTOR. By J. MILLNER.

ILLUMINATED SIGNS. By T. E. RUTHVEN MURRAY.

Dec. 16 RECENT DEVELOPMENTS IN ELECTRIC LIGHTING AND DEMONSTRATIONS OF LIGHTING EFFECTS.

1925

Jan. 27 THE EFFECT OF INTERNAL OBSTRUCTIONS ON THE PERFORMANCE OF A LIGHTING SYSTEM. By J. W. T. WALSH.

Feb. 18 Informal Meeting and Visit to Army and Navy Stores and Messrs. Selfridge's Ltd.

Mar. 3 Discussion on THE LIGHTING OF RAILWAY STATIONS and Visit to Waterloo Station.

May 19 A SURVEY OF THE LIGHTING OF 800 RETAIL SHOPS. By W. J. JONES and H. LINGARD.

June 9 NATURAL AND ARTIFICIAL SUNLIGHT IN HEALTH AND DISEASE. By DR. C. W. SALEEBY.

(Joint Discussion with the Sunlight League and other bodies interested.)

Discussed by :—

A. F. Berry, Dr. E. J. Deck, Dr. Eidenowe, Sir Richard Paget, D. N. Dunlop (Director of the B.E.A.M.A.), Dr. J. Kerr, Mr. R. Unwin, Dr. H. Munro, P. J. Waldram, J. R. Quain, Dr. O'Donovan, W. G. Raffé (12).

June 23 Visit to Drury Lane Theatre and Informal Discussion on STAGE LIGHTING.

Nov. 26 Opening Meeting devoted to Reports of Progress and Novelties in Illumination :—

RECENT PROGRESS IN ILLUMINATING ENGINEERING. By. L. GASTER.

THE "DIA" LONG-BURNING FLAME ARC LAMP. By CAPT. RISCH.

THE MUTOCHROME PROJECTOR. By S. H. GROOM.

THE CUBICAL INTEGRATING PHOTOMETER. By K. EDGCUMBE.

AN ANTI-DAZZLE HEADLIGHT. T. J. SACK.

ILLUMINATED RAILWAY NAME PLATES. By A. CUNNINGTON.

NEW FORMS OF LIGHTING FITTINGS. (R. A. IVES, H. H. LONG and A. J. DALLADAY.)

TIME SWITCHES. By J. HORSTMAN.

Dec. 16 PROGRESS IN ELECTRIC LAMPS AND LIGHTING APPLIANCES.

1926

Jan. 21. A CONSIDERATION OF SOME OF THE PSYCHOLOGICAL ASPECTS OF ILLUMINATION IN COAL MINES. By ERIC FARMER.

Feb. 25 STANDARDIZATION IN ILLUMINATING ENGINEERING :—

(1) THE BRITISH ENGINEERING STANDARDS ASSOCIATION; ITS AIMS AND OBJECTS. By P. GOOD.

(2) THE BRITISH STANDARDS SPECIFICATION FOR PORTABLE PHOTOMETERS. By LT.-COL. K. EDGCUMBE.

(3) THE BRITISH STANDARD SPECIFICATION FOR INDUSTRIAL REFLECTOR FITTINGS FOR ELECTRIC LIGHTING. By LT.-COMMANDER HAYDN T. HARRISON.

(4) THE BRITISH STANDARD GLOSSARY OF TERMS USED IN ILLUMINATION AND PHOTOMETRY. By P. GOOD.

Discussed by :—
H. Buckley, G. Campbell, R. A. Ives, Lt.-Col. C. H. Silvester Evans, H. C. Allpress, T. E. Ritchie, A. Cunnington, Capt. W. J. A. Liberty, L. G. Applebee, J. Darch, D. H. Ogley, C. A. Smith, W. J. Jones, G. J. Wells., F. W. Thorpe (15).

Mar. 30 STAGE LIGHTING. By. H. LESTER GROOM.

April 29 SCHOOL LIGHTING (MODERN REQUIREMENTS AND RECENT PROGRESS). By DR. J. KERR.

June 1 RESEARCH IN ILLUMINATING ENGINEERING, WITH PARTICULAR REFERENCE TO THE WORK OF THE ILLUMINATION RESEARCH COMMITTEE OF THE DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH. By J. W. T. WALSH.

Discussed by :—
C. C. Paterson, W. J. Jones, A. Cunnington, P. J. Waldram, W. C. Raffé, Miss A. R. Wiggins, J. S. Dow, R. C. Hawkins, J. Wilson, T. J. Sack, L. Gaster, Sir John Herbert Parsons, H. A. Allpress, Sir John Herbert Parsons (14).

Oct. 26 Opening Meeting devoted to Reports of Progress and Novelties in Illumination :—

A SUMMARY OF PROGRESS DURING THE VACATION. By L. GASTER.

PROGRESS IN ELECTRIC LIGHTING.

A SYSTEM OF SERIES LIGHTING ON ELECTRIFIED LINES. By A. CUNNINGTON.

SOME NOVEL LIGHTING INSTALLATIONS ON THE UNDERGROUND RAILWAYS. By S. G. ELLIOT.

A NEW FORM OF DAYLIGHT-FACTOR METER. By H. BUCKLEY.

THE NEW HOLOPHANE LUMETER. By H. ALLPRESS.

INTERNALLY FROSTED LAMPS. By L. E. BUCKELL.

THE USE OF COLOURED LIGHT IN DANCE HALLS. By W. G. RAFFÉ.

TIME SWITCHES. By L. C. SHARP.

THE SHERINGHAM REFLECTOR. By G. WHEATLEY.

A NEW SPOTLIGHTING UNIT. By L. G. APPLEBEE.

NEW TYPES OF LIGHTING FITTINGS. (MR. H. H. LONG and MR. C. HUGHES.)

N.B.—In the case of subjects on which much difference of opinion exists, or where the co-operation of corresponding members, kindred societies, or experts outside the ranks of the Society was secured, we are including the names of those who joined in the discussion, in order to illustrate the wide circle of experts interested in the work of the Society.—ED.

The Illuminating Engineering Society

(FOUNDED IN LONDON, 1909)

THE ILLUMINATING ENGINEERING SOCIETY, since its foundation in 1909, has provided an impartial platform for the consideration of all illuminants and lighting problems, and has been instrumental in creating a general recognition of the benefits of good illumination.

After eighteen years of useful work it is felt that the time is ripe for research and propaganda on a wider scale. Amongst the objects in view are the arrangement of lectures and demonstrations throughout the country, the formation of a fund for research, further extending the size of the Journal by including special contributions on selected subjects and, ultimately, the formation of sections of the Society in various cities in this country and in the Colonies and Dominions.

Progress necessarily depends on financial assistance and co-operation. **Those who have benefited from the movement and are desirous of promoting further progress can do so by filling in the accompanying form on the opposite page, for the purpose of:**

(1) **Becoming Members or Associates;**

(2) **Becoming Sustaining Members, *i.e.*, by paying a special contribution towards the propaganda work of the Society:**

(3) **Giving donations to form the nucleus of a special fund for research.**

"The Illuminating Engineer"

(The Journal of GOOD LIGHTING)

(Official Organ of the Illuminating Engineering Society)

(FOUNDED IN 1908)

THE ILLUMINATING ENGINEER, the official organ of the Illuminating Engineering Society, was founded in 1908. All discussions before the Society are fully reported, and its columns also contain particulars of other developments at home and abroad, new systems of lighting, and the latest methods of applying light in the service of mankind.

The Journal has been issued in a revised and extended form since January, 1925. Its "Popular and Trade Section" records new lamps and lighting devices as they appear, and contains descriptions of new and interesting installations.

The Journal has an extensive international connection, and is in a position to keep readers informed of Progress Abroad, thus acting as a centre of information from all parts of the world.

Members of the Illuminating Engineering Society receive the Journal regularly. Others may subscribe for the Journal, the Subscription for Great Britain, Colonies and Dominions, and the United States of America being 10s. per annum, *post free*, and for foreign countries 15s. per annum, *post free*.

In order to appeal to a wider circle of readers, additional subscriptions are desired, and a form of application (4) will be found on the opposite page.

POPULAR & TRADE SECTION

COMPRISING

Installation Topics—Hygiene and Safety—Data for Contractors—Hints to Consumers

(The matter in this section does not form part of the official Transactions of the Illuminating Engineering Society; and is based on outside contributions.)

Electric Light in Industry

The Relation Between Illumination and Efficiency

By W. J. JONES

IT is well known that increased artificial illumination brings about greater facility for working, but until quite recently we have almost entirely relied upon American sources for exact information. The tests made in America have now been substantially confirmed by some very interesting work undertaken jointly by the Medical Research Council and the Department of Scientific and Industrial Research, and the results of their researches are now published by the Stationery Office, under the title "The Relation Between Illumination and Efficiency in Fine Work (Type-setting by hand)."

The whole of the report is interesting and worth reading by all interested in electric lighting. The investigation took the form of an endeavour to find out the relationship between electric lighting and the ability to set type, and in every case daylight conditions were taken as the 100 per cent. figure. The following table gives a summary of the more important tests:

Test No.	Mean Illumination foot-candles	Average Hourly Output (ens)	Per cent. of Daylight Output	Errors in % of Output	Letters turned in % of errors
1	1.3	1,232	76.0	1.41	24.00
2	6.8	1,433	88.4	0.79	17.56
3	14.0	1,519	93.7	0.69	12.51
4	13.0	1,567	96.7	0.74	12.30
5	24.5	1,634	100.8	0.62	11.28
6	Daylight	1,621	100.0	0.61	10.48

The illumination was varied from 1.3 to 24.5 foot-candles, and it will be seen from an analysis of the above figures that, as the illumination increases, so the average output increases. Equally important, however, is the fact that with increase of illumination the number of errors decreases, and the number of turned letters decreases; so that simultaneously with increase of output the quality of the work improves.

The following conclusion extracted from the report is of great importance:

"The data presented here points very definitely to the existence of an optimum value of illumination for hand composing, which is of the order of 20 foot-candles. With such a value, provided by a well-planned installation designed to secure approximate uniformity of illumination over the whole area of work, it may be expected that the daylight rate of output will be maintained, at any rate, for the short periods which normally require the use of artificial light during the winter months.

The interests of employer and worker alike are seriously affected by inadequate lighting of composing rooms. If the illumination is less than 2 foot-candles nearly *one-quarter* of the possible output is lost, while the number of mistakes is more than doubled, and the fatigue experienced by the compositors is materially increased. Even when the illumination is as much as 7 foot-candles—a value which is probably higher than the present general practice—*over* 10 *per cent.* of the possible output is lost, and there is an unnecessarily high percentage of errors.

If work is done in artificial light only for a few hours a day there is no evidence that any undue ocular fatigue is likely to result, providing the illumination is uniform and of the order of 10 foot-candles. *The provision of higher values of illumination is largely an economic question, which the results of this investigation show to be well worthy of consideration.* If work has to be done continuously in artificial light, as in newspaper offices, the provision of higher values of illumination appears to be essential, if the efficiency of a night shift is to approach that of a day shift."

The economics of the situation are equally interesting; the report shows that at 2 foot-candles nearly *a quarter* of the possible output is lost, while the number of mistakes is more than double. An illumination of 20 foot-candles can generally be provided from the equivalent of three 100-watt gasfilled lamps for every 75 ft. super. Assuming that this is the amount of space taken up by three compositors, the running cost of providing 20 foot-candles at 4d. per unit would only be 1.2d per hour. On the same basis 2 foot-candles would cost 0.12d. per hour. The present Trade Union rate for compositors is 1s. 11d. per hour, so that the labour charges for three compositors would be 69d.

The following comparative figures are worked out on the above assumptions:

Illumination Provided	Output	Cost in pence per hour: Labour	Lighting	Total
2	75% possible	69	0.12	69.12
7	90% ,,	69	0.42	69.42
20	100% ,,	69	1.2	70.2

For a given amount of work under 2 foot-candles, the number of men must be increased to four to obtain the same output per hour as that obtained by three men under 20 foot-candles. We can therefore write:

2	Equivalent of 100%	92	0.16	92.16

Similarly we can write:

7	Equivalent of 100%	76.5	0.47	76.97

This shows a total saving under 20 foot-candles illumination of 22d. or 24 per cent. of the wages bill over that at 2 foot-candles. This saving is sufficient to provide the extra light *20 times over!*

Similarly compared with 7 foot-candles there is a total saving under 20 foot-candles of 6.77d. or 8.9 per cent. of the wages bill. In this instance the saving is sufficient to provide the extra light *9 times over!*

The cost of providing this good lighting is only *1.7 per cent. wages bill.*

The two Government Committees are certainly to be congratulated on the completion of such an important piece of work, and it is to be hoped that similar investigations will be undertaken in other industries.

"Sunray" Floodlighting Projectors

Various Types of "Sunray" Reflectors for Floodlighting

IN conjunction with his remarks in the discussion of the paper on "Floodlighting" at the last meeting of the Illuminating Engineering Society, Mr. L. G. Applebee exhibited a number of types of "Sunray" projectors, some of which are illustrated in Figs 1 to 4.

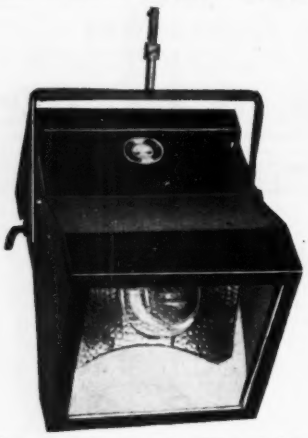


FIG. 1.—12 in. type for 300 and 400 watt lamps.

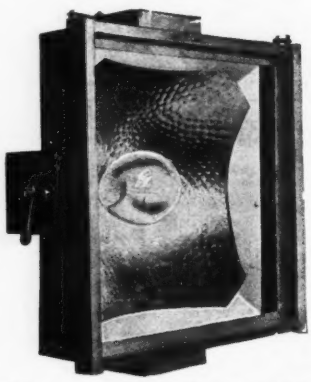


FIG. 2.—17 in. pattern for 500 or 1000 watt lamps.

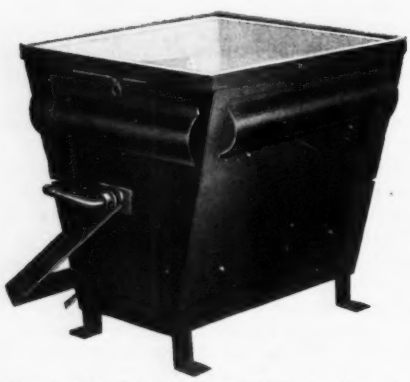


FIG. 3.—For 400 and 500 watt Projector lamps.

FIG. 4.—Wide Angle Outdoor Type for 500-watt lamps.

One feature of the demonstration was the exhibit of the 12 in. projector (Fig. 1) fitted with a "Restlight" colour glass so as to give an approximation to daylight. This was utilized for the illumination of a large oil painting (18 ft. by 14 ft.) in a well-known art gallery, and afforded an illumination of 7 foot-candles at a distance of 21 ft. Whilst not assumed to give an accurate "colour-true" effect this glass enables the colours to be seen much better than in ordinary artificial light.

Both the 12 in. and 17 in. types were used in connection with the Tattoo and other special lighting effects at the Wembley Exhibition. The outdoor Sunray square pattern (Fig. 3) was specially designed for use in cases where graduation of illumination, permitting some features to be accentuated, is advantageous. This type was used, for example, at Wembley in order to light the "Abdulla" kiosk, where the name was desired to be more prominent than the surroundings.

The new outdoor Sunray projector (Fig. 4) was designed to give a very wide beam-spread, and can be used either as an indoor stage-flood or an efficient watertight outdoor lantern flood. Unlike the previous models it is designed to accommodate any make of lamp.

It was remarked that much floodlighting could be improved by using a spotting lantern to give a long throw across a street; for poster lighting this should be specially effective.

Sheffield Illumination Society

The second social evening arranged in connection with the Sheffield Illumination Society was held at Messrs. Stephenson's Restaurant, Castle Street, Sheffield, on January 14th, when about 150 members and friends spent a most enjoyable evening. Amongst those present were Councillor R. H. Minshall (Chairman of the Lighting Sub-Committee), Councillor F. Thraves (Chairman of the Watch Committee) and Mrs. Thraves, Councillor A. Smith, Mr. J. F. Colquhoun (Public Lighting Engineer) and Mrs. Colquhoun.

Councillor R. H. Minshall presided, and in his opening remarks made a reference to the many improvements that have been carried out in the way of street lighting in Sheffield since Mr. Colquhoun took over his duties, and said that the Lighting Committee fully realized how necessary it was for a city to be well lighted.

The first portion of the evening consisted of a concert, the following artistes providing an excellent entertainment: Miss Lily Hanson (soprano); Miss Gladys Bransom (contralto); Mr. Robert Marrison (tenor); Mr. Fred Nicholson (baritone); Mr. Sydney Owen (violin); Mr. Jack Simmonite (humorist) with Mr. Ernest Roebuck, L.R.A.M., A.R.C.M., accompanist.

At the conclusion of the musical items Councillor F. Thraves moved a vote of thanks to the artistes and the Chairman, and remarked that the social side of a department helps very much in bringing everything good out of the employees. Councillor A. Smith associated himself with Councillor Thraves' remarks.

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2

The Medical Society of London dates from 1773. Its historic library contains thousands of valuable books of which extreme care is taken to keep them in a good state of preservation. Its meeting room is a very fine piece of decorative architecture. Smokeless fuel (solid or gaseous) is used everywhere for heating the Society's premises. The illustration shows a corner of the members' lounge, which is heated by a modern gas fire in pewter. The fire, surround and mantelpiece—all in perfect taste—were designed by one of our leading architects. The Secretary's flat is also heated by gas fires. In its exclusive use of smokeless fuel, the Medical Society of London shows the practical interest taken by its members in the movement for the abolition of smoke from our towns and cities.

Medical and Sanitary Authorities Show How to Increase the Hours of Sunshine

THOSE who are compelled to remain in this country during the long autumn and winter months have some cause to complain. Depressing periods of rain do occasionally give place to spells of fair weather; but too frequently these "fair" spells are made foul by the formation of thick blankets of smoke-fog.

This fog deprives us entirely of the healthy mental and physical stimulation which sunshine brings. The natural white fog is a characteristic of our island, a discomfort which we cannot escape. But the *smoke*-fog is an evil of our own making—*a preventable evil.*

Every coal fire we use is wastefully turning valuable chemicals into noxious smoke. The waste of these chemicals is greatly to be deplored from the national point of view; but when it is seen that the smoke, combining easily as it does with our natural fogs, recoils upon us—causing illness and death, stunted vegetation, blackened and deteriorated buildings, and heavy financial losses to the community in general—the almost criminal folly of burning crude coal is apparent.

The Council Hall of the Society of Medical Officers of Health is frequently filled to capacity, and when many of the members were smoking the air frequently became oppressive. To overcome this discomfort the original system of lighting was displaced by a ventilating gas lamp fixed near the ceiling in the centre of the room. This lamp and a gas-driven fan, to be seen at ceiling level on the right, ensure an adequate change of air under all conditions. The gas lamp is lighted and extinguished by the turning of a control tap placed near the door.

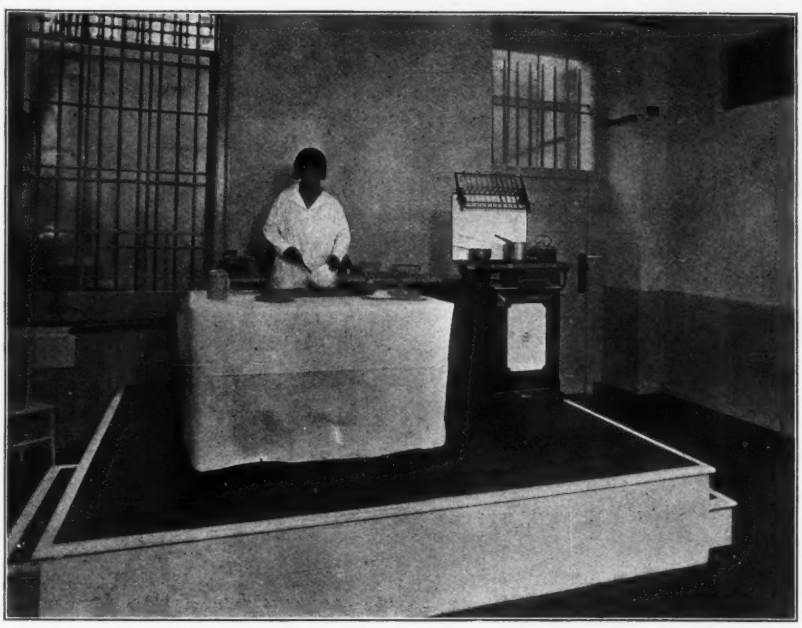
Authorities on medicine, hygiene and sanitation agree that Smoke is one of the great curses of this country. As scientific practical reformers they have taken active steps to ensure that they, at any rate, shall not be found guilty of creating it.

The following pages contain interior views of the headquarters of some of the leading national societies interested in medicine and public health. These illustrations reveal an aim that is common to them all—the abolition of grates which consume smoke-creating fuel and involve unending labour. Equally noticeable is their unanimity as to the practical means of obtaining this end. Their solution is, and has to be, one that not only satisfies the highest standards of hygienic heating but is thoroughly economical. It follows that when the responsible officials of these public bodies show the way towards the ideal of smokeless towns and cities, their method is one that can be practised by private individuals as well; and it has the best possible authority behind it.

An editorial of "Sunlight," the official organ of "The Sunlight League," aptly points out that "To-day we look back, with all the disgust of conscious superiority, upon the indifference of our forefathers to the first principles of sanitation and hygiene; in the not-distant to-morrow our long toleration of the smoke curse will be referred to as an example of the mingled patience and stupidity of the Georgian era."

The days of the smokeless city and of more sunlight are within our reach—an ideal whose achievement is being rapidly made sure by the methods described on this and the following two pages.

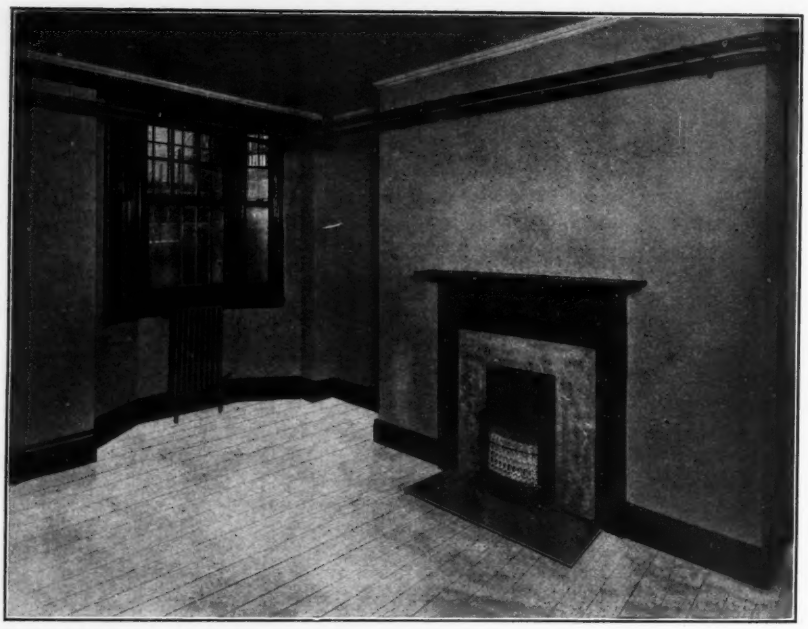
The Sunlight League, of which Her Late Majesty Queen Alexandra was the first Patron, aims at the education of the public to the appreciation of sunlight as a means of health—in the belief that such knowledge will also stimulate efforts for the abatement of smoke. No smoke is created in the headquarters of the Sunlight League, for in all of its offices smokeless fuel is used. The view shows the Association's Committee Room, which is also used when required by the various Associations of Head and Assistant Masters and Mistresses and other societies connected with the scholastic profession which are housed in the same building at 29, Gordon Square, London. There are no fewer than 28 gas fires in use in this building.



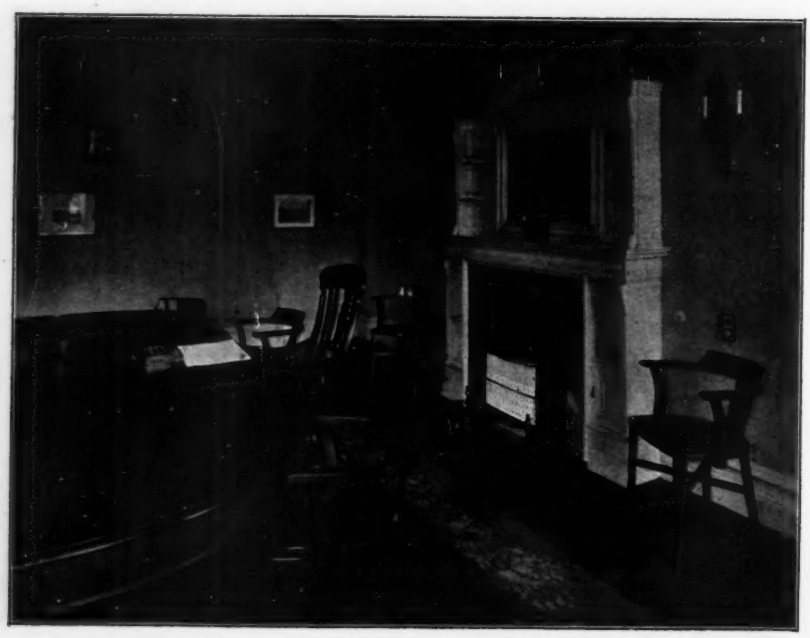
The Institute of Hygiene was founded in 1903. The formal opening of the Institute in its new and commodious premises took place on June 5th, 1925, when Her Royal Highness Princess Mary Viscountess Lascelles performed the inaugural ceremony. The illustration shows one end of the Demonstration Room. Gas cooking stoves are installed in this room for use in connection with lectures on hygiene and practical cookery given from time to time by skilled lecturers and demonstrators. As an association of practical reformers the Institute of Hygiene shows how to avoid the use of smoke-producing solid fuel for cooking purposes in the home.

A view of one end of the Lecture Room of the Institute of Hygiene. Here a very fine mantelpiece and hearth in statuary marble had to be suitably treated for the installation of a gas fire in place of the smoke-producing coal grate which had previously been in use. The gas fire chosen has an electro-silver finish, and the surround is of Scagliola marble. Thirteen smokeless gas fires of beautiful design are in use in the Institute of Hygiene —a practical recognition by our leading hygienists of the healthfulness of gaseous heating.

The New Health Society has rightly taken active steps to ensure that in the heating of its new headquarters no smoke shall be created. Hot water radiators deriving their heat from a coke boiler and gas fires are now used throughout the building. This old coal range was in use prior to the purchase of the building by the New Health Society. The room is now to be used as an office. The following illustration will therefore be of interest.



The coal range shown in the above illustration has been taken out, and the recess has been filled in, and a modern type of radiant ventilating gas fire with a suitable mantelpiece has been fixed in position. The room, which is a fairly large one, will now be made comfortably warm on most days by hot water radiators supplied with hot water from a coke boiler, but the heat will be supplemented on very cold days by that of the gas fire. The gas fire will also be used if cold snaps occur during seasons when the coke boiler is not in use. Gas is used for cooking and for heating water for domestic purposes in another room.



The Coal Smoke Abatement Society was formed in 1898 to further the aims of those who desire a cleaner atmosphere. One of its main aims is to promote and encourage all voluntary efforts to abolish smoke from dwelling houses, and to enquire into the best means of effecting this object. The provision in its headquarters of smokeless heating equipment is an example to be copied by all who realize the vast amount of illness and destruction caused by smoke. In the last fifteen years London's annual soot-fall has been actually more than halved. In the same period the number of gas appliances in use has more than doubled.

TRADE NOTES & ANNOUNCEMENTS

FLOODLIGHTING IN LIVERPOOL.

Now that the lighting restrictions are removed and business conditions are more normal, it is safe to say that floodlighting will become still more prominent in commercial circles.

In a number of the larger cities several excellent schemes are already in operation, notably in London, Liverpool, Swansea and Cardiff. Floodlighting has the effect of making prominent buildings even more outstanding after dark than during daylight, while the cost is moderate in the extreme.

Our night view of the Liverpool branch of the General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2, taken during the Liverpool Civic Week, shows the floodlighting results obtained from six G.E.C. I.E.2/86 floodlighting projectors fitted with 500-watt Osram G.E.C. projector lamps. These are spaced 6 ft. 6 in. apart and fixed on wood platforms 3 ft. 6 in. from the face of the building. The section floodlighted is approximately 43 ft. wide by 28 ft. high.

CORRECT FOCUSSING FOR AUTOMOBILE HEADLIGHTS.

It is one thing to design a satisfactory headlight for motor cars; but it is at least equally important that this should be correctly maintained. This point is emphasized in a leaflet issued by the General Electric Co. Ltd., referring to Osram anti-dazzle automobile lamps. Clear and concise instructions are given and illustrated by a series of photographs. For the benefit of readers we may recall that this anti-dazzle lamp utilizes a bulb with the upper portion colour-sprayed a yellow colour, so as to give a soft diffused light above the horizontal. It is important, in the first instance, to ensure that the yellow-sprayed region of the bulb is uppermost. The filament may be focussed by shifting the lampholder backwards or forwards, and it is also necessary to see that headlights are mounted correctly so that the beam is neither unduly raised nor depressed. Under proper mounting conditions, the cut-off lines of both beams should be level and the same height from the ground.

WESTINGHOUSE DEVELOPMENTS.

An illustrated booklet issued by the Westinghouse Electric and Manufacturing Co., of Pittsburgh, contains a complete record of the achievements of the Company during the year 1926. There is much information on the manufacture of plant and switchgear, and their installation in various industries. Under the heading of "Illumination," attention is drawn to the increased attention paid to street lighting in the United States. During the past year many outstanding installations have been made. The largest of these, in St. Louis, involves the allocation of no less than $8,000,000 for a complete rehabilitation of the old street lighting. Over 11,000 Hollowspun granite standards are being installed. Other important installations are those in the township of Tonowanda and Watertown (N.Y.). The most distinctive feature of these three installations is the use of the newly developed "Bi-lux" refractor. By the aid of the directional control exercised by these fittings the illumination on the roadway is stated to be increased 45 per cent.

Attention is also drawn to several special lamps and fittings. These include the newly developed diving lamp, utilizing a spherical concentrated-filament lamp of thick glass which will stand 130 lbs. per square inch pressure, and the new chromium-plated reflector whose lustre withstands sea-water, as it does fumes, dust and ordinary wiping. Lamp and reflector are directly immersed in water, without protection. An underwater housing suitable for use in the decorative lighting of fountains, swimming pools, etc., has also been developed. Yet another outstanding item was the illumination of the large "Liberty Bell" at the Sesqui-Centennial Exhibition, which utilized 20,000 lamps in shaded colours.

Magnet House, Liverpool, floodlighted by G.E.C. Projectors and Osram Lamps.

Several forms of units for the lighting of aeroplane landing fields are also illustrated. A lens gives a horizontal spread of 45°, and with a 1,500-watt projection lamp a maximum intensity of 250,000 candle-power is obtained; whilst with a plain lens and concentrated beam the maximum candle-power attains 3,000,000.

Yet another interesting development is the design of a new selenium cell which can be used to operate street lights, show-window lighting, signal lights, etc.

ELECTRIC LIGHTING IN THE HOME.

In order to link up with the E.D.A.—E.L.M.A. Better Home Lighting Campaign, the British Thomson-Houston Co. Ltd. are issuing an illustrated booklet entitled "Electric Lighting in the Home." This is divided into sections, a space being allotted respectively to the hall, dining-room, drawing-room, bedroom, kitchen and bathroom. In each case a representative set of fittings is illustrated so that readers can see at a glance what types are available.

DECORATIVE LIGHTING OF AUSTIN REED'S PREMISES.

From Messrs. Tyler & Freeman we receive a brief description of the above installation of Austin Reed's premises in Regent Street, in which B.T.H. trough reflectors have been used. Small curtains and blinds have been fitted to all the windows, the trough reflectors being mounted at the bottom of the window between the curtain and the blind. The effect is to give a very pleasing golden tone to the whole of the windows. If desired, colour effects can be obtained by fixing screens over the reflectors. A special feature is that the whole installation is entirely independent of the general lighting scheme of the building, so that any sections of the window lighting can be switched on and off as required.

THE LIGHTING OF ST. MARK'S CHURCH, SHEFFIELD.

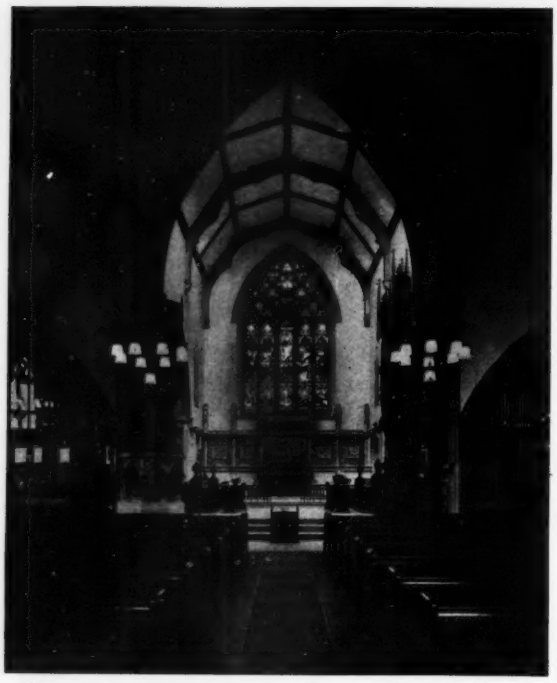


FIG. 1.—Showing Floodlighting of Chancel.

The two accompanying photographs, which have been furnished by Messrs. Metro-Vick Supplies Ltd., show an interesting church-lighting installation in the North of England, namely St. Mark's, Glossop Road, Sheffield. The fittings provided by Messrs. Metro-Vick Supplies Ltd. included two six-light Pentagon fittings, two nine-light Octagon 48-in. diameter fittings, other lighting being furnished by 36-in. diameter electroliers and single light brackets fitted with 200-volt 75-watt gasfilled white-sprayed lamps. A feature of special interest is the floodlighting, which is well illustrated above. For this purpose "Emvee" reflectors, fitted with 100-watt gasfilled lamps, are adopted.

We understand that the architect responsible was Mr. S. Elden Minns, whilst the electrical contractors were Messrs. Marsh Bros. of Fargate, Sheffield.

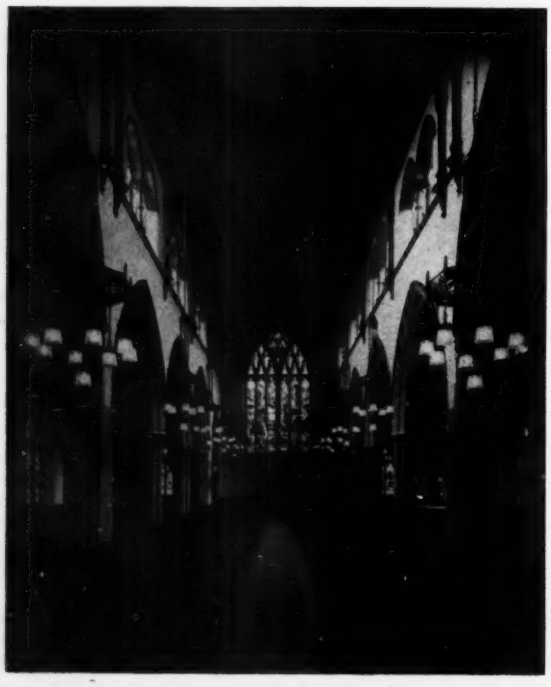


FIG. 2.—General view showing Main Features of Lighting Arrangements.

COLOUR LIGHTING IN KINEMA THEATRES.

A DEMONSTRATION BY HOLOPHANE LTD.

On Tuesday, January 11th, members of the General Council of the Kinematograph Exhibitors' Association attended a lecture and demonstration on colour lighting and its future application to the kinema, in the miniature theatre attached to the showrooms of Messrs. Holophane Ltd. (Elverton Street, Westminster, S.W.). The visitors were welcomed by Mr. E. Stroud, by whom Mr. R. G. Williams, the lecturer, was introduced. In the introductory portion of the lecture the chief facts of colour vision were recalled and methods of obtaining coloured light (by means of colour screens, varnished or lacquered lamps, colour-sprayed lamps, and special light sources) were discussed. Coloured light is now playing a much more important part than in the past, and presents great possibilities for kinema theatres.

The lecturer demonstrated, by means of a prism and a beam of light from a small projector, how light could be controlled by prismatic reflectors. This led to a description of the reflector used by the Holophane Company for stage-lighting and screen effects, and the special batten in which this reflector is incorporated. The "Duo-Phantom" batten, designed for kinema stages, can be operated from the floor of the stage or just above stage level, and is so designed that the audience are unable to see the source of light.

Subsequently the audience were given a practical demonstration of the changing colour effects possible with this apparatus. Some very startling changes were effected, and it was suggested that by means of colour lighting a person on the stage could be made to resemble, in turn, characters in the film. Various transformations were carried out. For example, a lady coming up on the platform in a slave costume appeared to be in a bathing dress under the coloured light. Some very beautiful coloured lighting units for interior lighting were also shown.

The use of colour for interludes, e.g., the gradual change in a picture on the screen, such as a desert scene, was illustrated, the gradual change of colours with sunset closely holding the attention of the audience. A film was also projected, and was made to float in a surround of colour, which changed as the film proceeded. It was pointed out that the colour could be modified in accordance with the emotional appeal of the film, thus accentuating the effect produced. Titles could also be shown on a coloured background. It was remarked that the use of colour by aid of the "Duo-Phantom" seemed to increase the depth of the picture and to give it more "body."

The lecturer also emphasized the great possibilities of colour lighting in kinema entrances, lobbies and waiting rooms, etc. Considerable interest in the various demonstrations was evinced by the audience, and there was a representative gathering of people interested in kinema work. After an interesting discussion a vote of thanks was moved by Mr. H. V. Davis, and the meeting dispersed.

PHILIPS LAMPS AT THE "ASTORIA" KINEMA THEATRE.

A feature of the new "Astoria" Kinema Theatre, in Charing Cross Road, opened on January 12th, is the lighting. In all, about 3,000 Philips lamps are used for the outside signs and 840 for the interior lighting, in addition to floodlighting lamps and special Philips projector lamps used for the kinematographic apparatus and display. The outside signs contain 600 vacuum "Daylight" blue lamps and 1,900 red, blue and yellow colour-sprayed and clear gasfilled lamps. The effect of these colour combinations is very striking. As regards the interior lighting the general effect is at once adequate and soft and restful, and conducive to the contented frame of mind that should precede the entertainment.

A View of the New Astoria Kinema Theatre, in Charing Cross Road, London, where Philips Lamps are installed.

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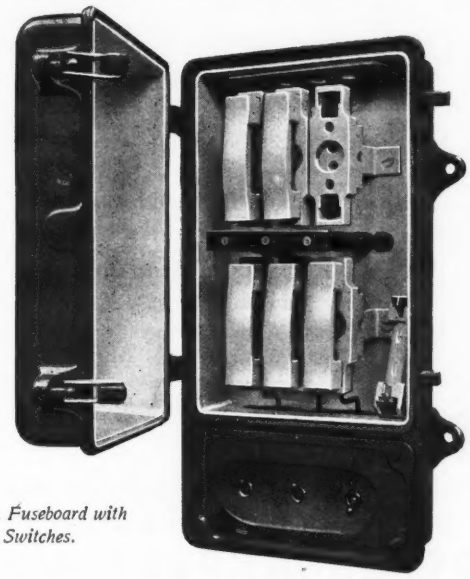

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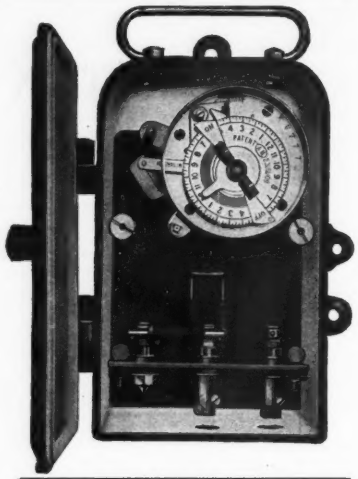

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Sheffield Illumination Society

The first lecture of session 1927 was held in the Corporation Lighting Department, Corporation Street, Sheffield, on the 25th January, when Mr. J. F. Colquhoun (Public Lighting Engineer) gave a "Talk on Burners" to the members of the Sheffield Illumination Society.

Commencing with Murdoch's first gas jet, the lecturer went on to the evolution of the flat-flame burner and the methods employed in breaking up the gas so as to obtain complete combustion. The disadvantages, as well as the advantages, of a high gas pressure, and their effect, was also carefully dealt with. Continuing, the speaker described the first incandescent gas burner used by Von Welsbach, and the evolution of the incandescent gas burner.

The control of a gas flame next provided the members with some very interesting data of a practical nature, many tests being demonstrated, e.g., how a flame could be controlled by the size of nipple, by air ports, size of Venturi tube, and by the size of nozzle, was illustrated, together with the effect of different qualities of gas at different pressures. The effect of pre-heating the gas before ignition, and the means employed to obtain that pre-heating, was also under discussion.

Mr. Colquhoun also referred to the change over from upright to inverted mantles in Sheffield, and pointed out that in consequence there are now more than three times the number of mantles in use than formerly; yet the number of mantles now needed for maintenance purposes per annum is less. The number of burners when upright mantles were used was approximately 10,000. At the present time there are over 30,000 mantles in use, and the mantle bill is down.

A number of old-time burners were exhibited, and the lecture was also illustrated by a large collection of lantern slides very kindly loaned to Mr. Colquhoun by Mr. S. B. Langlands, the Inspector of Lighting for Glasgow Corporation.

The meeting was presided over by the President, Mr. H. Lazenby, and a very hearty vote of thanks to Mr. Colquhoun terminated a highly interesting and very instructive evening.

Progress of the E.D.A.-E.L.M.A. Better Lighting Campaign

According to accounts received considerable progress has recently been made in connection with this campaign. It is hoped shortly to bring the number of demonstration houses in the South Midlands area up to 14, and local centres have recently been formed in Loughborough, Chesterfield, Shrewsbury, and elsewhere. The demonstration house at Walsall was opened on January 1st, and two are being opened in Leicester. The electric home arranged by the Huddersfield Committee is stated to have been exceptionally successful, and up to December 17th had been visited by 20,000 people. Attendance at the Leeds demonstration house has averaged 300 per day, and the house in Halifax was visited by nearly 10,000 people during the first 10 days. Demonstration houses have also been recently opened in Harrogate, Wakefield, and Nottingham. To date over 30 demonstration electric homes have been started.

Institution of Public Lighting Engineers

New Address

We are requested to notify readers that from now onwards the address of the Institution of Public Lighting Engineers will be General Buildings, Aldwych, London, W.C.2, to which correspondence intended for the Hon. Secretary (Capt. W. J. Liberty) should be sent.

REVIEWS OF BOOKS AND PUBLICATIONS RECEIVED

Owing to limitations of space we are this month unable to deal fully with several interesting publications, reviews of which must be deferred to our next number. We should like to mention, however, two books of special value, to which the attention of readers may be invited. The first of these is the work by Major Klein on Colour Music, published by Crosby, Lockwood & Son (London), which surveys the whole history of efforts to utilize colour as an appeal to the senses, in the same manner as the ear is fascinated by musical sounds. The various "colour organs" devised from time to time are described, and other applications of coloured light, for instance on the stage and in the kinema theatre, are discussed. The book is illustrated by numerous attractive colour plates. The second publication, which has been awaited with much interest, is the account of the Proceedings of the Optical Convention, now available in two imposing volumes. Readers will recall that a full account of the papers read (over 100 in number) was given in *The Illuminating Engineer* of May 1st. The papers cover a very wide ground. Many of them deal directly with illumination and photometry, others primarily with optical instruments, but all are of scientific interest. The two volumes are being published by The Optical Convention (1, Lowther Gardens, Exhibition Road, London, S.W.7), from whom full particulars may be obtained. Attention may also be drawn to the most recent issue of the *Transactions* of the Illuminating Engineering Society (U.S.A.), which contains an exceptionally interesting series of papers, including the set on different subjects designed to illustrate progress in illumination during the past 20 years.

PHOTOMETRY

BY

JOHN W. T. WALSH

M.A. (Oxon.), M.Sc. (Lond.), A.M.I.E.E., F.Inst.P.

Member of the National Illumination Committee of Great Britain; General Secretary of the International Commission on Illumination.

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